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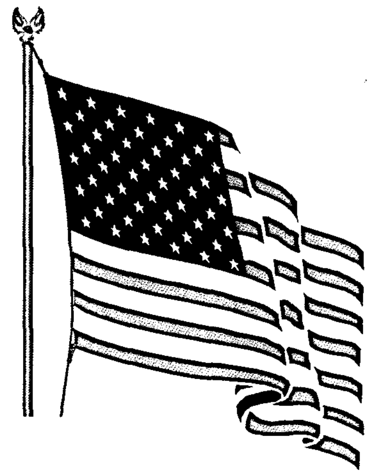

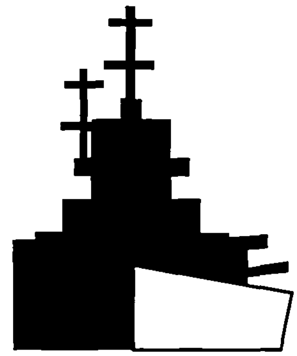

FINAL FEASIBILITY STUDY REPORT IR SITE 24 ALAMEDA POINT ALAMEDA, CALIFORNIA

September 2008

Contract No. N68711-95-D-7526
CTO-0087
BEI-7526-0087-0048.R1

Submitted to:

Department of the Navy
Base Realignment and Closure
Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108-4310

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COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY

CLEAN 3

FINAL
FEASIBILITY STUDY REPORT
IR SITE 24
ALAMEDA POINT
ALAMEDA, CALIFORNIA

September 2008

Prepared by:

BECHTEL ENVIRONMENTAL, INC.
1230 Columbia Street, Suite 400
San Diego, California 92101-8502

REGISTERED PROFESSIONAL ENGINEER
JANET L. ARGYRES
No. 38414
Exp. 3/31/09
CIVIL
STATE OF CALIFORNIA

Signature: ______________________ Date: 9/19/08
Daniel Carroll, CTO Leader

Signature: ______________________ Date: 9/19/08
Janet Argyres, PE 38414, Project Manager

CHANGE PACKAGE

FINAL FEASIBILITY STUDY REPORT FOR IR SITE 24 ALAMEDA POINT ALAMEDA, CALIFORNIA

Please make the following page replacements to the draft final version of the Feasibility Study Report for IR Site 24, dated September 2008. This change package will constitute the final version of this document.

Remove and discard the following pages[a]	Insert the following replacement pages[b]
Main Report Text	
Document spines	Document spines
Document covers	Document covers
Signature Page (September 2008)	Signature Page (September 2008)
Pages ES-3 and ES-4 (one double-sided page)	Pages ES-3 and ES-4 (one double-sided page)
Pages ES-7 and ES-8 (one double-sided page)	Pages ES-7 and ES-8 (one double-sided page)
Table ES-1 (one page)	Table ES-1 (one page)
Pages i and ii of the TOC (one double-sided page)	Pages i and ii of the TOC (one double-sided page)
Pages 3-3 through 3-12 (five double-sided pages)	Pages 3-3 through 3-12 (five double-sided pages)
Pages 5-3 and 5-4 (one double-sided page)	Pages 5-3 and 5-4 (one double-sided page)
Pages 6-5 through 6-16 (six double-sided pages)	Pages 6-5 through 6-16 (six double-sided pages)
Pages 6-19 and 6-20 (one double-sided page)	Pages 6-19 and 6-20 (one double-sided page)
Pages 7-1 and 7-2 (one double-sided page)	Pages 7-1 and 7-2 (one double-sided page)
Tables 3-2 and 3-3 (one double-sided page)[c]	Tables 3-2 and 3-3 (one double-sided page)[c]
Table 6-1, pages 1 and 2 of 3 (two 11×17 pages)	Table 6-1, pages 1 and 2 of 3 (two 11x17 pages)
Appendices	
Appendix B, pages B-5 through B-12 (four double-sided pages)	Appendix B, pages B-5 through B-12 (four double-sided pages)
Appendix C Table of Contents (pp. C-1 and C-2)	Appendix C Table of Contents (pp. C-i and C-ii)
Appendix C, cover sheet and select pages of RTCs on Draft FS Report from U.S. EPA (cover; pages 1 and 2 of 22, pages 15 and 16 of 22; pages 17 and 18 of 22)[d]	Appendix C, cover sheet and select pages of RTCs on Draft FS Report from U.S. EPA (cover; pages 1 and 2 of 22, pages 15 and 16 of 22; pages 17 and 18 of 22)[d]
Appendix C, cover sheets for RTCs on Draft FS Report from DTSC-HERD, DTSC-PM, and ARRA	Appendix C, cover sheets for RTCs on Draft FS Report from DTSC-HERD, DTSC-PM, and ARRA
CD	
Draft final CD in pouch inside front cover of binder	Final CD in pouch inside front cover of binder
Add the following new pages to Appendix C:	
New RTCs on Draft Final FS from U.S. EPA (cover and pages 1 and 2 of 2)	
New RTCs on Draft Final FS from DTSC-HERD (cover and page 1 of 1)	

Notes:

[a] unchanged text pages show document control number BEI-7526-0087-0048 in the header

[b] changed text pages show document control number BEI-7526-0087-0048.R1 in the header; unchanged pages are included only when necessary for double-sided printing

[c] only Table 3-2 has changed; Table 3-3 provided for double-sided copying only

[d] only text on Comment 3 on page 2 of 22, Comment 25 on page 15 of 22, and Comment 38 on page 17 of 22 changed; pages 1 of 22, 16 of 22, and 18 of 22 are provided for double-sided copying only

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CLEAN 3 TRANSMITTAL/DELIVERABLE RECEIPT

Contract No. N-68711-95-D-7526 **Document Control No. BEI-7526-0087-0048.R1**

File Code: 0214

TO	Contracting Officer NAVFAC Southwest Ms. Graciela R. Steinway, AQE.GS 1220 Pacific Highway San Diego, CA 92132-5190	DATE: CTO #: LOCATION:	September 29, 2008 0087 Alameda, California

FROM: Janet L. A
Janet L. Argyres, Project Manager

DESCRIPTION: **(Replacement Pages and CD)** Final Feasibility Study Report for Installation Restoration Site 24, Alameda Point – Dated September 2008

TYPE: Contract Deliverable (Cost) ____ CTO Deliverable (Technical) X Other: ____

VERSION: Final (e.g., Draft, Draft Final, Final, etc.) REVISION No: 1 ~~2~~ (~~of transmittal only~~) JM 10/14/08

ADMIN RECORD: (PM to Identify) Yes X No ____ U.S. EPA Category ____ Confidential ____

SCHEDULED DELIVERY DATE: 9/29/08 ACTUAL DELIVERY DATE: 9/29/08

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Bechtel Job No. 23818
Contract No. N68711-95-D-7526
File Code: 0214

IN REPLY REFERENCE: BEI-7526-0087-0048.R1

September 29, 2008

Contracting Officer
NAVFAC Southwest
Ms. Graciela R. Steinway, AQE.GS
1220 Pacific Highway
San Diego, CA 92132-5190

Subject: Replacement Pages and CD for Final Feasibility Study Report for Installation Restoration Site 24, Alameda Point, Alameda, California Dated September 2008

Dear Ms. Steinway:

Enclosed, please find seven copies of the re-issued replacement pages along with a CD for the Final Installation Restoration Site 24, Alameda Point, Alameda, California, dated September 2008. As directed by the Navy RPM, we are concurrently transmitting copies to Ms. Anna-Marie Cook of U.S. EPA, Ms. Dot Lofstrom of DTSC, and Mr. John West of the RWQCB. In addition, we are forwarding copies on behalf of the Navy to the parties listed on the attached transmittal sheet.

If you have any questions, please contact me at (415) 768-9917.

Very truly yours,

Janet L. Argyres
Project Manager

Enclosure

BECHTEL ENVIRONMENTAL, INC.

CLEAN 3 TRANSMITTAL/DELIVERABLE RECEIPT

Contract No. N-68711-95-D-7526 **Document Control No. BEI-7526-0087-0048**

File Code: 0214

TO	Contracting Officer NAVFAC Southwest Ms. Graciela R. Steinway, AQE.GS 1220 Pacific Highway San Diego, CA 92132-5190	DATE: CTO #: LOCATION:	September 17, 2008 0087 Alameda, California

FROM: Janet L. Argyres
Janet L. Argyres, Project Manager

DESCRIPTION: Draft Final Feasibility Study Report for Installation Restoration Site 24, Alameda Point – Dated September 2008

TYPE: Contract Deliverable (Cost) ______ CTO Deliverable (Technical) X Other: ______

VERSION: Draft Final (e.g., Draft, Draft Final, Final, etc.) REVISION No: 0

ADMIN RECORD: (PM to Identify) Yes X No ___ U.S. EPA Category ___ Confidential ___

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P. Brooks, BPMOW.PB (1C/1E)	H. Carter (1C/1E)	J. West (1C/1E)	RWQCB
J. Kowalczyk, BPMOW.JK (1C/1E)	PDCC Files (1C/1E)	X. Tran (2C/2E)	
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CLEAN 3 Program
Bechtel Job No. 23818
Contract No. N68711-95-D-7526
File Code: 0214

IN REPLY REFERENCE: BEI-7526-0087-0048

September 17, 2008

Contracting Officer
NAVFAC Southwest
Ms. Graciela R. Steinway, AQE.GS
1220 Pacific Highway
San Diego, CA 92132-5190

Subject: Draft Final, Feasibility Study Report for Installation Restoration Site 24, Alameda Point, Alameda, California

Dear Ms. Steinway:

Enclosed for your review, please find seven copies of the Draft Final Feasibility Study Report for Installation Restoration Site 24, Alameda Point, Alameda, California, dated September 2008. As directed by the Navy RPM, we are concurrently transmitting copies to Ms. Anna-Marie Cook of U.S. EPA, Ms. Dot Lofstrom of DTSC, and Mr. John West of the RWQCB. In addition, we are forwarding copies on behalf of the Navy to the parties listed on the attached transmittal sheet.

If you have any questions, please contact Dan Carroll, CTOL, at (619) 744-3041 or me at (415) 768-9917.

Very truly yours,

Janet L. Argyres

Janet L. Argyres
Project Manager

Enclosure

EXECUTIVE SUMMARY

Bechtel Environmental, Inc., has prepared this Feasibility Study (FS) Report for Installation Restoration (IR) Program Site 24 on behalf of the Department of the Navy Base Realignment and Closure (BRAC) Program Management Office West under Contract Task Order (CTO) 0087 of the Comprehensive Long-Term Environmental Action Navy 3 Program, Contract No. N68711-95-D-7526. The Navy follows current United States Environmental Protection Agency (U.S. EPA) guidance for FS report preparation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Title 42, *United States Code* (U.S.C.) Sections (§§) 9601–9675 (1988). Figures and tables are included at the end of this summary.

IR Site 24, referred to as the Pier Area, is located along the southern edge of Alameda Point (formerly Naval Air Station [NAS] Alameda) in Alameda, California (Figures ES-1 and ES-2). The site is currently being used to dock naval ships and other large vessels. In September 1993, NAS Alameda was designated for closure by the United States Congress and the BRAC Commission. The base officially closed in April 1997.

This FS Report develops and evaluates remedial action alternatives to address potential ecological risks associated with contaminated sediment in a small portion of the sediment shelf at IR Site 24. The Navy will use the results of this evaluation and other site-specific information to select an appropriate remedy for sediment at IR Site 24. Based on the ecological risk assessment (ERA) results included in the Remedial Investigation (RI) Report, an FS was recommended for a small area located in the northeastern corner of the IR Site 24 sediment shelf in the vicinity of the quay wall and beneath the wharf road between storm drain Outfalls J and K. The RI Report concluded that there were no unacceptable risks in other areas of IR Site 24.

SITE BACKGROUND

IR Site 24 is approximately 50 acres in size and includes open-water areas and three piers located within the breakwall of Breakwater Beach. The Navy began using the piers, which are constructed with concrete pilings/footings and walkways, in 1943. Pier 1 is the smallest and northernmost of the three piers. Pier 2 (the middle pier) has four berthing spaces. These berthing spaces historically accommodated a combination of destroyers, service ships, and transient vessels for loading and offloading small amounts of ordnance. Piers 2 and 3 were used to berth nuclear-powered ships as well as occasional nuclear-powered submarines.

The City of Alameda currently leases pier space at the site to the United States Department of Transportation, Maritime Administration. Under the proposed future reuse plan, IR Site 24 will be developed as a commercial marina along with the adjacent Seaplane Lagoon; there are currently no plans to remove the piers. The area south of Pier 3 is slated for transfer to the California Department of Fish and Game for use as a marina.

Until 1978, the pier areas were dredged periodically to allow for large naval ships to be docked. Consequently, much of the shallow sediment in the pier area that could have contained contaminants related to shipboard waste and storm drains was removed. However, a sediment shelf along and underneath the quay wall was not accessible to the dredging equipment previously used at IR Site 24. The water depth at the pier face ranges from approximately 12 to 28 feet. Access to the sediment shelf area under the wharf road by boat is largely blocked by pier pilings and cross members. Only one entrance beneath the pier is available for access; access in this area is possible only at low tide.

Three storm drains discharge into IR Site 24 (Figure ES-3). Storm drain lines leading to Outfalls J and K discharge into the northeastern end of the site between Piers 1 and 2; the storm drain line leading to Outfall L discharges between Piers 2 and 3. The storm drain line leading to Outfall J received runoff and industrial wastewater from buildings located east of IR Site 24 in environmental baseline survey (EBS) Parcels 154 and 201, including Buildings 166 and 167, which were large buildings historically used as aircraft maintenance hangars. Activities conducted in these buildings reportedly included painting, resin mixing, parts washing in solvent dip tanks, metals machining, paint stripping/sandblasting, aircraft defueling and refueling, and replacing or filling of lubrication and hydraulic fluids. The open spaces of EBS Parcels 154 and 201 were historically used for aircraft parking and maintenance and for chemical, equipment, and material storage, which included hazardous material storage yards and an industrial dust silo. It is suspected that potentially contaminated surface runoff from the parcels and historically industrial wastewaters may have discharged through storm drain lines leading to Outfall J in IR Site 24.

Sediment is the primary exposure medium at IR Site 24. Surface water is not considered a medium of concern at IR Site 24 because metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and pesticides are relatively insoluble, and partitioning from sediment to surface water is low. During the RI, sediment samples were collected and analyzed for PAHs, PCBs, pesticides, and metals. Investigations indicated that these chemicals were present in sediment, with the highest concentrations reported primarily in samples collected in an area located in the northeastern section of the site and beneath the wharf road between storm drain Outfalls J and K. A review of the spatial distribution of the analytical results reported for the 2006 samples revealed that elevated concentrations of metals, pesticides, and PCBs were all co-located in sediment samples collected in this northeastern area beneath the wharf road. The RI Report recommended an FS for this area, which has been designated as the area of ecological concern (AOEC) for this FS Report (Figure ES-3).

Concentrations of metals and organic chemicals in sediment in the open-water portions of IR Site 24 were low, and the RI Report recommended no further action for the open-water portion of the site. There is no evidence that the sediment in the AOEC is acting as a secondary source to sediment in the open-water portions of IR Site 24.

The human health risk assessment (HHRA) conducted during the RI did not identify complete exposure pathways for human receptors due to the limited habitat for shellfish at the site, as well as the limited and difficult access to the water and shoreline for recreational and shellfish harvesting purposes. The ERA concluded that risks were acceptable over most of the site, and that the only area with a potential for adverse ecological impacts was the sediment shelf in the northeastern corner of the site. The potential risk in this area is expected to be limited due to the small size of the area and because the sediment shelf area is located behind the quay wall and beneath the wharf road, where access by ecological receptors is likely to be minimal. Based on the ERA results, the RI Report recommended that an FS be conducted for the AOEC only.

REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) are medium-specific (e.g., sediment, soil, groundwater, or air) or operable unit–specific goals for protecting human health, welfare, and the environment. RAOs are established based on affected media, chemicals of concern, existing and potential receptors and exposure pathways, and applicable or relevant and appropriate requirements (ARARs).

The general response objective for IR Site 24 is to protect ecological receptors from unacceptable exposure to chemicals of concern (COCs) through exposure to sediments or consumption of contaminated organisms.

The RI Report described potential risk for ecological receptors exposed to surface sediment (0 to 2 inches or 0 to 5 centimeters [cm]) at IR Site 24. The benthic invertebrate community (principally invertebrates that live in or on the sediment at the bay bottom) is potentially at risk from sediment contaminants due to direct contact and ingestion exposure. Three representative bird receptors (surf scoter, double-crested cormorant, and California least tern) are potentially at risk from cadmium, lead, total DDx (the sum of the pesticides DDT [dichlorodiphenyltrichloroethane], DDE [dichlorodiphenyldichloroethene], and DDD [dichlorodiphenyldichloroethane]), and total PCBs, due to ingestion of contaminated food and incidental ingestion of surface sediment. The RI Report did not indicate potential risk to fish receptors from surface sediment exposures. However, subsurface sediment (deeper than 2 inches or 5 cm), if available to ecological receptors, is associated with potential risk to invertebrates, fish, and birds. The RI Report noted that these receptors were likely at risk only from contaminant concentrations in the AOEC.

The RI Report identified the key risk drivers as cadmium, lead, total DDx, and total PCBs for ecological receptors. Because these are the same chemicals that are present in adjacent Seaplane Lagoon (IR Site 17), where remediation goals (RGs) have been developed, and due to the uncertainties noted in the RI Report, the development of preliminary RGs for IR Site 24 is supplemented by data and analysis conducted for the adjacent Seaplane Lagoon.

During the development of the RG for cadmium in sediment at IR Site 17, protective sediment values for cadmium for the protection of fish at Seaplane Lagoon were estimated to range from 19.6 to 61.9 milligrams per kilogram (mg/kg) dry weight. These ecological protective sediment values were based on literature-based values and a site-specific bioaccumulation factor (BAF). However, the available cadmium data set was considered insufficient for developing a final RG. Therefore, the cadmium concentration in sediment considered protective of fish at IR Site 17 was used as the RG for the protection of avian receptors. Similarly, for IR Site 24, the cadmium data were insufficient to develop an RG that would be protective of fish, and therefore the avian RG is also considered protective of fish receptors at this site.

RGs protective of the least tern and other avian receptors (surf scoter and double-crested cormorant) were calculated for IR Site 17 for cadmium, total DDx, and total PCBs, but not for lead, because of uncertainties associated with the bioavailability and toxicity of lead to avian receptors. The spatial distribution of sediment lead concentrations in the AOEC at IR Site 24 is similar to the distribution of cadmium concentrations; therefore, the RG for cadmium is expected to mitigate potential risk due to lead concentrations as well.

Due to the uncertainties described in the RI Report associated with the estimated risks, particularly with the site-specific estimates of bioaccumulation used to develop BAFs, calculation of site-specific RGs would have similar uncertainties. Therefore, the RGs adopted in the final Record of Decision for adjacent IR Site 17 (Seaplane Lagoon) are used in this FS Report as preliminary RGs for IR Site 24. These preliminary RGs for sediment are as follows:

- cadmium – 24.4 mg/kg
- total DDx – 0.13 mg/kg
- total PCBs – 1.13 mg/kg

Consideration will be given to achieving an areawide average total PCB concentration that is consistent with the upper-bound nearshore ambient concentration for total PCBs (i.e., 0.2 mg/kg). The area-weighted average total PCB concentrations within IR Site 24 following remediation will be comparable to the upper bound estimate (i.e., 0.2 mg/kg) of the nearshore ambient concentration calculated for the San Francisco Bay area.

SCREENING OF REMEDIAL TECHNOLOGIES

Remedial technologies for consideration in this FS Report have been identified based on U.S. EPA guidance, remedial technology literature, engineering judgment, and Alameda Point experience. Remedial technologies that were incorporated into alternatives that were carried forward for detailed analysis in this FS Report are summarized below.

No Action

No action is included as an option because it is the baseline for comparison with other response actions.

Institutional Controls

Institutional controls (ICs) are legal and administrative mechanisms used to implement land use and access restrictions to limit the exposure of future landowner(s), recreational user(s) of the property, and/or ecological receptors to hazardous substances. ICs also may be used to achieve continued protectiveness (e.g., to protect a sediment cap) or to maintain the integrity of the remedial action until remediation is complete and RGs have been achieved. ICs would not treat impacted sediment, but would prohibit unacceptable exposure to the contaminants by ecological receptors.

Monitored Natural Recovery

Monitored natural recovery (MNR) uses ongoing, naturally occurring processes to contain, destroy, or reduce the bioavailability or toxicity of contaminants in sediment. MNR involves the isolation and mixing of contaminants through natural sedimentation, and is the process most frequently relied upon for contaminated sediment. This natural "capping" process at IR Site 24 would form a protective barrier that would minimize resuspension of impacted sediment and exposure of ecological receptors to contaminants in sediment. MNR is considered appropriate for the AOEC at IR Site 24 because this area is protected from high-energy forces such as boat wakes, propeller scour, keel drag, or large-boat anchoring that would minimize the effectiveness of the natural sedimentation process.

The natural processes of interest for MNR may include a variety of processes which , under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, or concentration of contaminants in the sediment bed. Natural MNR processes may include the following:

- physical processes – sedimentation, advection, diffusion, dilution, dispersion, bioturbation, and volatilization
- biological processes – biodegradation, biotransformation, phytoremediation, and biological stabilization
- chemical processes – oxidation/reduction, sorption, or other processes resulting in stabilization or reduced bioavailability

Under certain conditions, these natural processes act to reduce the mass, toxicity, mobility, or volume of contaminated sediment. Monitoring is typically performed to check the progress of the natural recovery process.

Containment

In situ capping was selected as the representative process option for containment technologies in this FS Report. Capping refers to the placement of a subaqueous covering or cap using clean material. The cap is placed over impacted sediment to isolate contaminants from the surrounding environment and potential receptors. Depending on the contaminants and sediment environment, a cap is designed to reduce risk through one or more of the following functions:

- physical isolation of the impacted sediment to reduce exposure due to direct contact and to reduce the ability of burrowing organisms to move contaminants to the surface
- stabilization and erosion protection of impacted sediment and cap to reduce resuspension and transport to other sites
- chemical isolation of impacted sediment to reduce exposure from dissolved and colloidally bound contaminants transported into the water column

Sediment Removal

Dredging was selected as the sediment removal technology to be evaluated in this FS Report. Dredging is an effective technology for removing contaminated sediment from an impacted aquatic environment. It is effective at addressing any class of contaminant (i.e., organic or inorganic), as it physically and nonselectively removes impacted sediment. Dredging processes involve mechanically grabbing, raking, cutting, or hydraulically scouring the bottom of a water body to dislodge the sediment. Once dislodged, the sediment may be removed either mechanically with buckets or hydraulically by pumping.

In Situ Treatment

In situ treatment involves using biological, physical, or chemical processes to treat impacted sediment in place. These processes may be used to break down contaminants and/or alter their properties so they can be easily extracted, destroyed, stabilized, or immobilized.

REMEDIAL ALTERNATIVES

The following six remedial alternatives for sediment are developed and screened in this FS Report:

- Alternative 1 – no action
- Alternative 2 – ICs
- Alternative 3 – MNR with ICs
- Alternative 4 – thin-layer capping with ICs
- Alternative 5 – sediment removal/dredging
- Alternative 6 – *in situ* grouting with ICs

Alternative 6 was screened out because *in situ* grouting has uncertain effectiveness, is in the early stages of development, and few delivery methods are currently commercially available. All other alternatives were retained for detailed analysis. The alternatives retained after screening are described below.

Alternative 1 – No Action

For this alternative, no action of any type would be conducted to mitigate potential ecological risks associated with impacted sediment at IR Site 24. This alternative is included in accordance with the NCP, and serves as a basis against which other alternatives may be compared.

Alternative 2 – ICs

Alternative 2 would rely on ICs to minimize disturbance and dispersion of the impacted sediment underneath the wharf road into the open-water area. Five-year reviews would be included to evaluate the continued protectiveness of the ICs for this alternative. Time until RAOs are achieved would not be known for this alternative.

ICs would be put in place at IR Site 24 to:

- prohibit disturbance of sediments in the AOEC under the wharf road, and
- prohibit removal of the wharf road (including land-use restriction/structure maintenance agreements) without prior approval from regulatory agencies and the Navy.

ICs would remain in place until RAOs were achieved and the Navy and regulatory agencies agreed that the site no longer posed potentially unacceptable ecological risk. For cost-estimating purposes, the assumed duration of Alternative 2 is 30 years.

Alternative 3 – MNR With ICs

Alternative 3 would rely on natural recovery processes to continue to isolate impacted sediment and reduce exposure of ecological receptors to COCs in sediment over time at the AOEC. A predesign investigation would be conducted at 18 sampling stations to verify the extent of COCs in sediment at concentrations exceeding preliminary RGs, and to serve as a baseline against which subsequent sediment monitoring results would be compared. Core samples would be collected at 9 of the 18 sampling locations to determine the sedimentation rate at the AOEC. Surface water samples would be collected at four locations in areas with elevated cadmium for analysis to evaluate cadmium efflux from sediment into overlying water.

A long-term MNR program, including periodic reviews, would be implemented to confirm that natural processes (e.g., sediment deposition) were occurring and to track remediation progress. If predesign investigation results for cadmium efflux analysis indicated potential risk, then additional cadmium efflux sampling would be performed as part of the post-remediation monitoring program. ICs would be included that are similar to those described for Alternative 2 to prohibit disturbance of sediment in the AOEC and to prohibit actions that would interfere with the MNR activities. For cost-estimating purposes, the duration of the MNR program and ICs under Alternative 3 is assumed to be 30 years. However, once sediment monitoring results indicated that RAOs were achieved and that ICs were no longer warranted, the regulatory agencies and the Navy would determine whether the MNR program and ICs could be discontinued.

Alternative 4 – Thin-Layer Capping With ICs

Alternative 4 consists of installation of a thin-layer cap over the impacted sediment in the AOEC at IR Site 24 where concentrations of COCs in sediment exceed preliminary RGs. The placement of a thin-layer cap would provide physical isolation of contaminated sediment from potential ecological receptors and accelerate natural recovery processes. In addition to thin-layer capping, Alternative 4 would also include ICs. The ICs would be similar to those described for Alternative 2. The same predesign investigation included in Alternative 3 would be included as part of Alternative 4, except that baseline sediment sampling would include 10 permanent sampling stations and 30 temporary sampling stations (a total of 40 sampling locations) with collection of one sample per location to determine cap placement locations. Furthermore, no core samples would be collected as part of this alternative.

A long-term monitoring program, including periodic reviews, would be implemented to verify that the thin-layer cap is performing as intended, and to track progress of natural recovery processes. If predesign investigation results for cadmium efflux analysis indicated potential risk, then additional cadmium efflux sampling would be performed as part of the post-remediation monitoring program. Once sediment monitoring results indicated that RAOs were achieved and that ICs were no longer warranted, the ICs would be discontinued. For cost-estimating purposes, the assumed duration of Alternative 4 is 30 years.

Alternative 5 – Sediment Removal/Dredging

Alternative 5 would employ dredging or a similar technology to remove sediment with COC concentrations exceeding preliminary RGs in the AOEC. The dredged sediment would be disposed in an off-site commercial or hazardous waste landfill. Removal of impacted sediment would be verified through confirmation sampling. The same predesign investigation included in Alternative 4 would also be included as part of Alternative 5, except that two sediment samples (shallow and deep) would be collected from each of the 40 sampling locations to further assess the vertical extent of the impacted sediment before removal. No ICs or long-term O&M activities would be implemented under this alternative. The assumed duration of Alternative 5 is 1 year.

COMPARATIVE ANALYSIS OF ALTERNATIVES

The relative performance of the retained remedial alternatives considered in this FS Report were compared against the NCP evaluation criteria in order to assess the merits of each alternative and identify key trade-offs the Navy must consider when selecting a cleanup remedy. The NCP criteria are as follows:

- threshold criteria
  - overall protection of human health and the environment
  - compliance with ARARs
- primary balancing criteria
  - long-term effectiveness and permanence
  - reduction of toxicity, mobility, or volume through treatment
  - short-term effectiveness
  - implementability
  - cost
- modifying criteria

- state acceptance
- community acceptance

The NCP threshold criteria must be satisfied for a remedial alternative to be eligible for selection unless an ARAR waiver applies. The selection of eligible remedial alternatives is generally based on a comparison of how well an alternative meets the five primary balancing criteria and the two modifying criteria. Alternative 1 does not meet the threshold criteria, so it was not evaluated against the balancing criteria. Alternatives 2, 3, 4, and 5 meet the threshold criteria.

Alternatives 2 through 5 were ranked for each of the balancing criteria in terms of their performance relative to other alternatives. Alternatives that performed best relative to other alternatives were assigned a score of "high." Alternatives that received the best combination of relative rankings scored highest overall in the balancing criteria. Therefore, no individual balancing criterion was weighted more heavily than others in this process. Table ES-1 summarizes the results of the comparative analysis by balancing criteria for remedial alternatives.

The remedial alternatives are not required to meet all five of the balancing criteria, although it is preferred. Evaluation against modifying criteria is the final test in determining whether the state and the community find the alternative acceptable.

Alternatives 2, 3, 4, and 5 meet the threshold criteria for current and anticipated future land uses of IR Site 24. Alternative 1 does not meet the threshold criteria for current and anticipated future land uses of IR Site 24. Alternative 5 is rated highest overall in satisfying the balancing criteria. Alternatives 2, 3, and 4 are rated lower than Alternative 5 in the balancing criteria.

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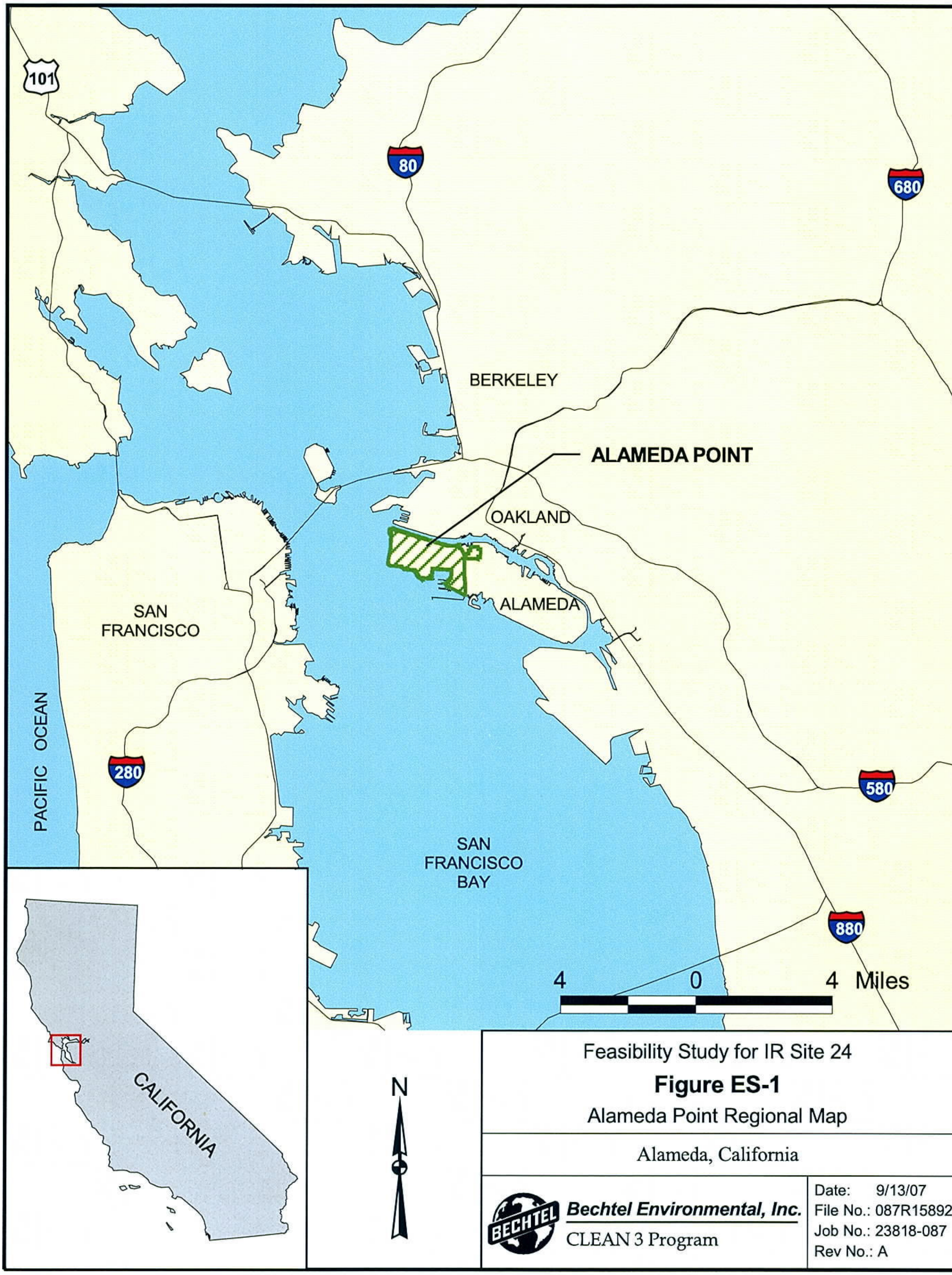


Feasibility Study for IR Site 24

Figure ES-1

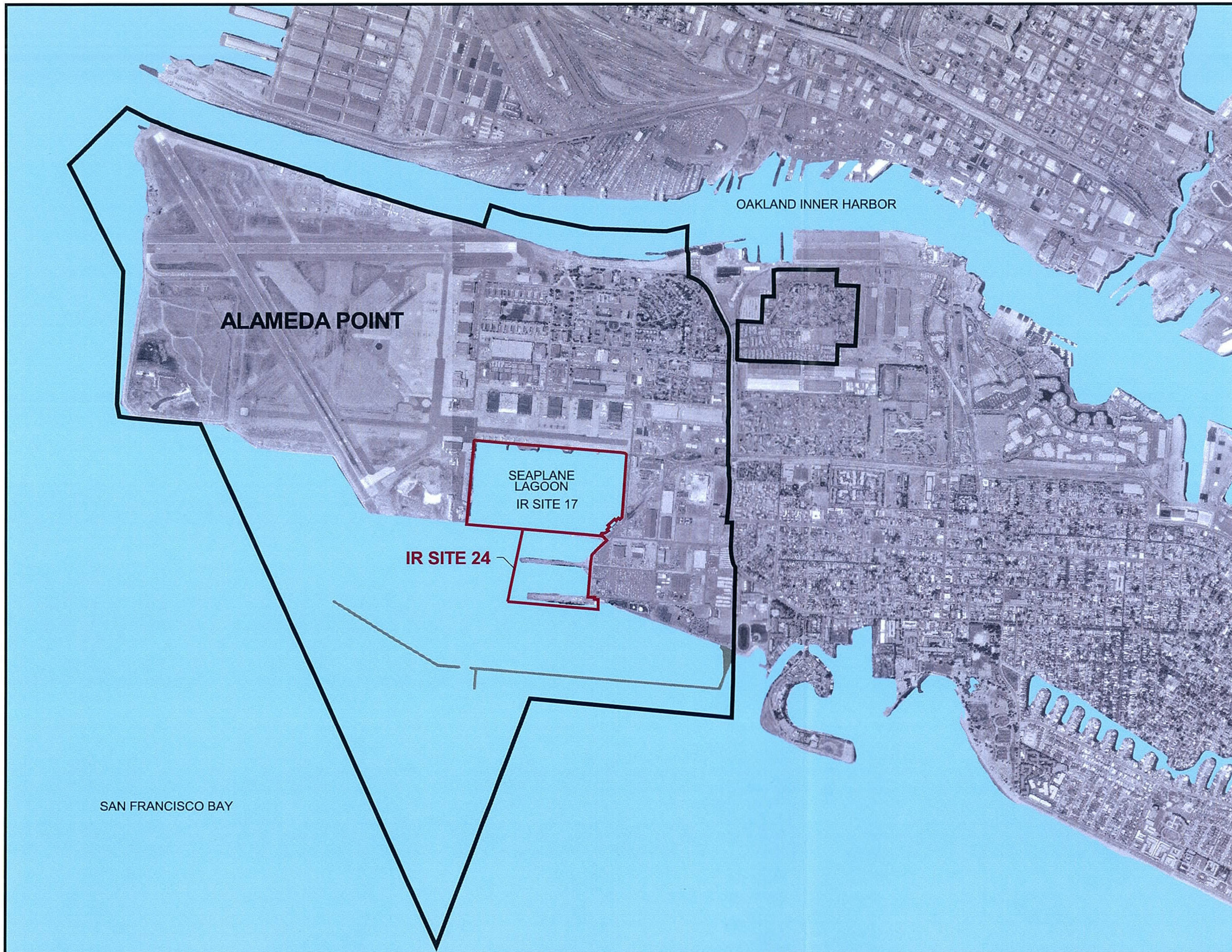
Alameda Point Regional Map

Alameda, California

Bechtel Environmental, Inc.

CLEAN 3 Program

Date: 9/13/07
File No.: 087R15892
Job No.: 23818-087
Rev No.: A



LEGEND

IR SITE BOUNDARY

ALAMEDA POINT NAVY PROPERTY BOUNDARY

WATER

NOTES:

IR – INSTALLATION RESTORATION (PROGRAM)

N

2000 0 2000 Feet

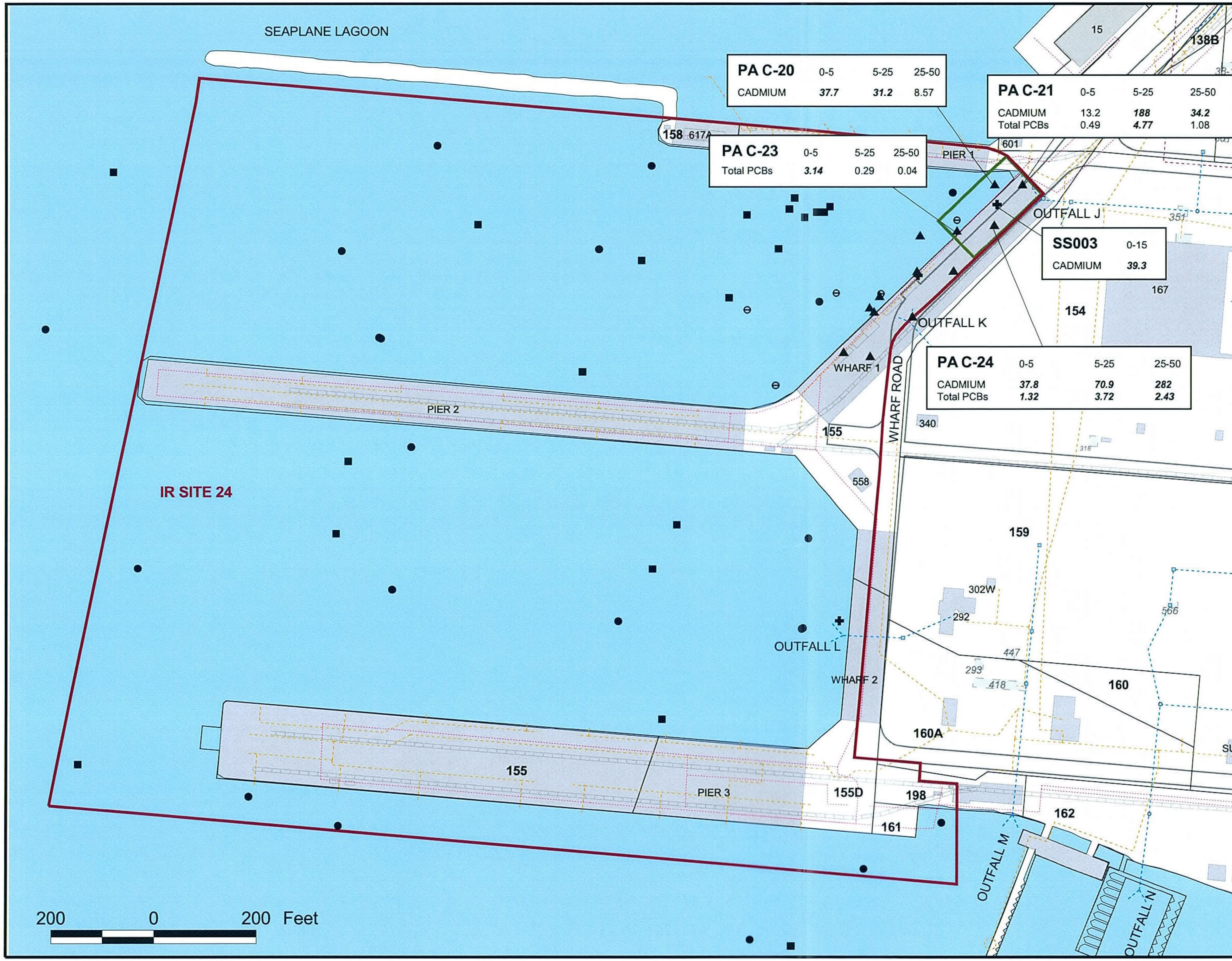
Feasibility Study for IR Site 24

Figure ES-2

Site Location Map

Alameda, California

Bechtel Environmental, Inc. CLEAN 3 Program	Date: 11/7/07 File No.: 087L15893 Job No.: 23818-087 Rev No.: C



LEGEND

- IR SITE 24 BOUNDARY
- ROAD
- WATER
- 155 EBS PARCEL BOUNDARY
- HISTORICAL RAILROAD
- 497 BUILDING OR STRUCTURE (PRESENT)
- 300 BUILDING OR STRUCTURE (REMOVED)
- MANHOLE
- CATCH BASIN
- STORM DRAIN
- SANITARY SEWER LINE
- FUEL LINE (REMOVED)

HISTORICAL SEDIMENT SAMPLING LOCATIONS
- 1996
- 1997
- 1998
- 2005
- 2006

- AREA OF ECOLOGICAL CONCERN

STATION ID — SAMPLING INTERVAL IN CM BELOW SEDIMENT SURFACE

SS003 0-15
CADMIUM 39.3

ANALYTE — CONCENTRATION IN mg/kg

N

ANALYTE	PRELIMINARY REMEDIATION GOAL (mg/kg)
CADMIUM	24.4
Total PCBs	1.13
Total DDx	0.13

NOTES:

ALL UNITS ARE mg/kg. RESULTS ABOVE PRELIMINARY REMEDIATION GOALS ARE SHOWN IN ***BOLD ITALICS.***

RESULTS REPORTED FOR TOTAL DDx ARE BELOW PRELIMINARY REMEDIATION GOALS

RESULTS REPORTED FOR CADMIUM AND PCB COGENERS (USED TO CALCULATE TOTAL PCB VALUES) WERE TAKEN FROM BATTELLE et al. 2007.

CM – CENTIMETERS (1 CM = 0.0328 FOOT)
DDx - SUM OF THE PESTICIDES DDT [DICHLORODIPHENYLTRICHLOROETHANE], DDE [DICHLORODIPHENYLDICHLOROETHENE], AND DDD [DICHLORODIPHENYLDICHLOROETHANE]
EBS – ENVIRONMENTAL BASELINE SURVEY
IR – INSTALLATION RESTORATION (PROGRAM)
mg/kg – MILLIGRAMS PER KILOGRAM
PCB – POLYCHLORINATED BIPHENYL

Feasibility Study for IR Site 24

Figure ES-3

Area of Ecological Concern With Exceedances of Preliminary Remediation Goals

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 9/16/08
File No.: 087L15894
Job No.: 23818-087
Rev No.: G

Table ES-1
Comparative Analysis Summary for Remedial Alternatives

NCP Criteria	ALTERNATIVE				
	1 No Action	2 ICs	3 MNR With ICs	4 Thin-Layer Capping With ICs	5 Sediment Removal / Dredging
Overall protectiveness	No[a]	Yes[b]	Yes	Yes	Yes
Compliance with ARARs	NA	Yes	Yes	Yes	Yes
Long-term effectiveness and permanence	NA	○	○	◑	●
Reduction of toxicity, mobility, or volume through treatment	NA	○	○	○	◑
Short-term effectiveness	NA	◑	◑	●	◑
Implementability	NA	●	●	◑	◑
Cost[c] ($M)	NA	● 0.43	◑ 1.13	○ 2.05	○ 3.32

Notes:
- [a] the no action alternative is protective of current and planned future land uses, but is not protective for a hypothetical future residential use
- [b] U.S. EPA does not concur that Alternative 2 meets the threshold protectiveness criterion.
- [c] cost estimates are based on net present value, where a low cost rating indicates > $2M; a medium cost rating indicates between $1M and $2M; and a high cost rating indicates < $1M

Acronyms/Abbreviations:
- ARAR – applicable or relevant and appropriate requirement
- IC – institutional control
- M – million
- MNR – monitored natural recovery
- NA – not applicable
- NCP – National Oil and Hazardous Substances Pollution Contingency Plan
- U.S. EPA – United States Environmental Protection Agency

Relative Performance:
- ○ = low
- ◑ = medium
- ● = high

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ACRONYMS/ABBREVIATIONS

AOEC	area of ecological concern
ARAR	applicable or relevant and appropriate requirement
BAF	bioaccumulation factor
BCDC	Bay Conservation and Development Commission
BCT	BRAC Cleanup Team
bcy	bank cubic yards
bgs	below ground surface
BRAC	Base Realignment and Closure
BSU	Bay Sediment Unit
BTAG	Biological Technical Assistance Group
CAD	contained aquatic disposal
Cal. Code Regs.	*California Code of Regulations*
Cal/EPA	California Environmental Protection Agency
Cal. Gov't. Code	*California Government Code*
CDF	confined disposal facility
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
C.F.R.	*Code of Federal Regulations*
CLEAN	Comprehensive Long-Term Environmental Action Navy
cm	centimeter
COC	chemical of concern
COPEC	chemical of potential ecological concern
CTO	contract task order
CZMA	Coastal Zone Management Act
DDD	dichlorodiphenyldichloroethane
DDE	dichlorodiphenyldichloroethene
DDT	dichlorodiphenyltrichloroethane
DDx	the sum of the pesticides DDT, DDE, and DDD
DTSC	(Cal/EPA) Department of Toxic Substances Control
EBS	environmental baseline survey
EDC	economic development conveyance
EPC	exposure point concentration
ERA	ecological risk assessment
ER-M	effects range-median
° F	degrees Fahrenheit
FFA	Federal Facility Agreement
FS	feasibility study
FWBZ	first water-bearing zone

HHRA	human health risk assessment
HQ	hazard quotient
IAS	initial assessment study
IC	institutional control
IDW	investigation-derived waste
IR	Installation Restoration (Program)
ISB	*in situ* bioremediation
kg	kilogram
LIFOC	Lease in Furtherance of Conveyance
µg/kg	micrograms per kilogram
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MLLW	mean lower low water
MNA	monitored natural attenuation
MNR	monitored natural recovery
MOA	memorandum of agreement
MSL	mean sea level
NAS	Naval Air Station
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
O&M	operation and maintenance
OSWER	Office of Solid Waste and Emergency Response
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PP	proposed plan
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
Res.	resolution
RG	remediation goal
RI	remedial investigation
ROD	record of decision
§	section
SIP	Policy for Implementation of Toxic Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California
SPAWAR	Space and Naval Warfare Systems Center

SUF	site-use factor
SWBZ	second water-bearing zone
SWRCB	(California) State Water Resources Control Board
TBC	to be considered
tit.	title
TRV	toxicity reference value
TSD	treatment, storage, and disposal
UCL	upper confidence limit
U.S.C.	*United States Code*
U.S. EPA	United States Environmental Protection Agency
Water Board	San Francisco Bay Regional Water Quality Control Board

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Section 1
INTRODUCTION

Bechtel Environmental, Inc., prepared this Feasibility Study (FS) Report for Installation Restoration (IR) Program Site 24 on behalf of the Department of the Navy Base Realignment and Closure (BRAC) Program Management Office West under Contract Task Order (CTO) 0087 of the Comprehensive Long-Term Environmental Action Navy 3 Program, Contract No. N68711-95-D-7526. The Navy follows current United States Environmental Protection Agency (U.S. EPA) guidance for FS report preparation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Title (tit.) 42, *United States Code* (U.S.C.) Sections (§§) 9601–9675 (1988).

IR Site 24, referred to as the Pier Area, is located along the southern edge of Alameda Point (formerly Naval Air Station [NAS] Alameda) in Alameda, California (Figures 1-1 and 1-2). The site consists of open water and three piers located within the breakwall of Breakwater Beach and is currently being used to dock naval ships and other large vessels.

In September 1993, the United States Congress and the BRAC Commission designated NAS Alameda for closure. The BRAC program goal is to transfer the closed base property and facilities to the community as expeditiously as possible and with minimal impact on the local economy. On July 22, 1999, Alameda Point was placed on the U.S. EPA National Priorities List (CA2170023236). IR Site 24 was added to the CERCLA program in January 2003, based on sampling results from previous investigations that indicated there may be chemicals of potential ecological concern (COPECs) in sediment that could pose an unacceptable risk to ecological receptors. The remedial investigation (RI) was completed and documented in the RI Report in August 2007 (Battelle et al. 2007). The RI results indicated that only a small area in the northeastern corner of IR Site 24 required further action. An FS was recommended to evaluate remedial options to address ecological risk associated with COPECs in sediment in the sediment shelf at the northeastern corner of the site. The sediment shelf area extends eastward from the quay wall under the wharf road between storm drain Outfalls J and K.

The Navy is responsible for environmental restoration at IR Site 24. The Navy established the IR Program to comply with federal requirements regarding cleanup of hazardous waste sites. Specifically, the task of the program is to reduce the risk to human health and the environment from past waste disposal operations and hazardous materials spills at Navy and Marine Corps facilities in a cost-effective manner. The federal requirements are outlined in CERCLA, as amended by the Superfund Amendments and Reauthorization Act of 1986 (42 U.S.C. § 9601 et seq.) and its implementing regulation, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 *Code of Federal Regulations* [C.F.R.] Part [pt.] 300 et seq.). The Navy provides copies of draft reports to the BRAC cleanup team (BCT) including the U.S. EPA, the California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC), the San Francisco Bay Regional Water Quality Control Board (Water Board), and others as appropriate, for comment as part of the CERCLA process.

1.1 PURPOSE AND METHODOLOGY

The purpose of this FS Report is to develop and evaluate remedial action alternatives to address potential ecological risks associated with sediment in the northeastern corner of

IR Site 24. The Navy will use the results of this evaluation and other site-specific information to select an appropriate remedy for this sediment.

The FS methodology is summarized below and further detailed in subsequent sections of this FS Report. It includes the following steps (U.S. EPA 1988).

- Establish remedial action objectives (RAOs).
  - Identify applicable or relevant and appropriate requirements (ARARs).
  - Establish response objectives for environmental media of concern (e.g., sediment, soil, groundwater, air).
- Identify general response actions, including no action, to meet RAOs for each medium of concern.
- Identify volumes or areas of environmental media for which remedial response actions may be needed.
- Identify remedial technologies and representative process options under each general response action, based on technical considerations.
- Screen remedial technologies and process options on the basis of effectiveness, implementability, and cost.
- Assemble the retained technologies and process options into remedial alternatives representing a range of treatment and containment combinations.
- Screen remedial alternatives, considering effectiveness, implementability, and cost.
- Evaluate retained remedial alternatives in detail against the following nine criteria specified in the NCP:
  - overall protection of human health and the environment
  - compliance with ARARs
  - long-term effectiveness and permanence
  - reduction of toxicity, mobility, or volume through treatment
  - short-term effectiveness
  - implementability
  - cost
  - state acceptance
  - community acceptance
- Perform a comparative evaluation of remedial alternatives.

This FS Report does not identify or recommend a preferred remedial alternative. However, the FS report is the primary document used by the Navy to select a preferred site remedy. Comments made during public meetings (including the Restoration Advisory Board (RAB) meetings and the public meeting for the proposed plan [PP]) and from regulatory agency reviews will also be evaluated and considered during the remedy-selection process. As required by the NCP and U.S. EPA guidance (U.S. EPA 1988), public comments on the PP will be addressed and documented in the responsiveness summary included in the record of decision (ROD).

1.2 REPORT ORGANIZATION

This FS Report is divided into an executive summary, eight sections, two appendices, and two attachments. Figures and tables are presented at the end of this FS Report.

- Section 1 provides an overview of the CERCLA FS process and presents the report organization.
- Section 2 presents background information about Alameda Point and IR Site 24, including significant findings from previous investigations.
- Section 3 outlines RAOs and ARARs.
- Section 4 identifies and screens various remedial technologies and process options for sediment.
- Section 5 presents the development of remedial alternatives and screens the alternatives as appropriate.
- Section 6 provides a detailed description of each retained remedial alternative and analyzes these alternatives using NCP criteria.
- Section 7 provides a comparison of the relative performance of these alternatives against NCP criteria.
- Section 8 lists references cited in this FS Report.
- Appendix A presents an ARARs analysis for remedial alternatives.
- Appendix B presents supporting cost information and cost development summaries for remedial alternatives.
- Attachment A is the Memorandum of Agreement (MOA) between the Navy and the DTSC regarding land-use restrictions.
- Attachment B is the Navy guidance document for land-use controls: Principles and Procedures for Specifying, Monitoring, and Enforcement of Land-Use Controls and Other Post-ROD Actions.

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Section 2
BACKGROUND

This section provides a description and history of Alameda Point and a description of IR Site 24. Site history, previous investigations, and physical setting are described. A conceptual site model is presented, including a description of the nature and extent of contamination, a summary of risk assessments performed for the site, and conclusions and recommendations from the RI Report (Battelle et al. 2007).

2.1 BASE DESCRIPTION AND HISTORY

The U.S. Army acquired the original base property from the City of Alameda in 1930 and began construction activities in 1931. In 1936, the Navy acquired title to the land from the Army and began building an air station in response to the military buildup in Europe before World War II. Construction of NAS Alameda included the filling of tidelands, marshlands, and sloughs with dredged materials from the San Francisco Bay and Oakland Inner Harbor. The base operated as an active naval facility from 1940 to 1997.

A variety of operations were conducted by the Navy at Alameda Point, including aircraft, engine, gun, and avionics maintenance; engine overhaul and repair; fueling activities; plating, stripping, and painting activities; and dial painting using radioluminescent paint. The Navy Public Works Center (PWC) also operated two power plants, a transportation shop, and a pesticide shop at Alameda Point. Historical aviation and jet engine test activities at Alameda Point were supported by a network of fuel delivery pipelines that transported aviation fuel and other fuels to various areas of Alameda Point (IT 2001). In addition, the base operated a deepwater port capable of berthing aircraft carriers. The port was used primarily for minor carrier maintenance and ship overhaul.

2.2 SITE DESCRIPTION AND OPERATIONS

IR Site 24 is located along the southern portion of Alameda Point (Figure 1-2). The site is approximately 50 acres in size and includes open-water areas and three piers located within the breakwall of Breakwater Beach. The Navy began using the piers, which are constructed with concrete pilings/footings and walkways, in 1943 (NEESA 1983). A single row of treated wood pilings, spaced every 5 feet (1.5 meters) and extending 2 feet (0.6 meter) from the piers, runs along the perimeter of the piers and quay walls. Piers 2 and 3 (Figure 2-1) were used to berth nuclear-powered ships as well as occasional nuclear-powered submarines (DON 2000). Repair work on radioactive components was routinely conducted on these ships but not on the piers (Battelle et al. 2007).

2.2.1 Pier Areas

Berthing areas at the piers were dredged to approximately 46 feet (14 meters) for navigational purposes. Pier 1 is the smallest and northernmost of the three piers with a berth space of approximately 405 yards (370 meters). Pier 2 (the middle pier) has four berthing spaces with a total available space of 807 yards (738 meters). These berthing spaces historically accommodated a combination of destroyers, service ships, and transient vessels for loading and offloading small amounts of ordnance. Pier 3 (the southernmost pier) is the largest berthing facility with an available berth space of 833 yards (762 meters); the USS *Hornet* is permanently docked at Pier 3 as a naval museum (Battelle et al. 2007). The City of Alameda currently leases pier space at the site to the United States Department of Transportation, Maritime Administration, who dock large vessels at Pier 1. Under the proposed future reuse plan (EDAW 1996), IR Site 24 will be developed as a commercial marina along with the adjacent Seaplane Lagoon; there are currently no plans to remove the piers. The area south of Pier 3 will be transferred to the California Department of Fish and Game as a marina (Battelle et al. 2007).

Until 1978, the pier areas were dredged periodically to allow for large naval ships to be docked. Consequently, much of the shallow sediment in the pier area that could have contained contaminants related to shipboard waste and storm drains was removed (NEESA 1983). However, the sediment shelf along and underneath the quay wall was not accessible to the dredging equipment previously used at IR Site 24. Based on observations made during a site visit in 2006, the sediment shelf between Piers 1 and 2 extends eastward past the quay wall beneath the wharf road. The area under the wharf road is difficult to access by land because there are no open walkways or ladders. A few emergency exit ladders are present, but none of them reach solid or intertidal ground; the ladder bottoms have contact with floating or attached large wooden beams. The water depth at the pier face ranges from approximately 12 to 28 feet. Access to the sediment shelf area under the wharf road by boat is largely blocked by pier pilings and cross members. Only one entrance beneath the pier is available for access; access in this area is possible only at low tide (Battelle et al. 2007).

2.2.2 Storm Drain Lines Leading to IR Site 24

The storm drain system at Alameda Point was initially constructed by the Navy to collect surface runoff from streets, runways, tarmac, landscaped areas, and building roof drains. Prior to 1972, wastes from industrial operations were discharged into the storm drain system. After 1972, as a result of the Clean Water Act, the Navy stopped direct discharge of industrial wastes to the storm drain system; wastes were diverted to industrial waste treatment plants, treated on-site, and then routed to the East Bay Municipal Utility Department sanitary sewer (DON 1996). Residual sediments remaining in the storm drain system were considered a potential source of contaminants to the offshore areas. As a result, the storm drain system at Alameda Point was designated as IR Site 18 since it served as a primary transport route for chemicals from industrial operations and for surface water runoff to reach the offshore sites (Battelle et al. 2007). After several investigations and removals, the Navy issued a technical memorandum in February 2000 that removed IR Site 18 as a specific IR site because existing line information indicated that no additional sediment removal was required (Battelle et al. 2007, TtEMI 2000b). Subsequent to the removal of IR Site 18, it was decided that remaining actions relative to storm drain lines would be addressed as part of the activities planned at the specific IR sites where the lines are a potential concern.

During the 1990s, the Navy cleaned, repaired, and replaced a significant portion of the storm drain system (DON 2006). In 1991, the Navy initiated several removal actions designed to remove residual contaminated sediments from the storm drain lines. Storm drain lines discharge into IR Site 24 through Outfalls J, K, and L (Figure 2-1). Storm drain lines leading to Outfalls J and K discharge into the northeastern end of IR Site 24 between Piers 1 and 2; storm drain lines leading to Outfall L discharge between Piers 2 and 3. Storm drain lines leading to Outfalls K and L were replaced with polyvinyl chloride piping in 1991 (Battelle et al. 2007). The storm drain lines leading to Outfall J were cleaned and inspected in 1991 (TtEMI 1996). Outfall J serves a large drainage area boundary that includes IR Sites 4, 9, 13, 19, 22, and 23 and EBS Parcels 132, 134, 139, 140, 141 154, 155, 164, and 201. Outfall K serves a smaller drainage area including only portions of EBS Parcels 154, 155, and 157. Outfall L also serves a small drainage area including only portions of EBS Parcels 155, 160, 161, and 198. There are no IR sites located within the drainage areas for Outfalls K or L (TtEMI 2001).

Between 1995 and 1997, a two-phase CERCLA time-critical removal action for sediment and debris in the storm drain system was performed (TtEMI 2000b). Phase I consisted of vacuum cleaning sediment and debris from storm drain catch basins and manholes associated with a number of outfalls including Outfalls J, K, and L at IR Site 24. Phase II consisted of cleaning the manholes and subsystem lines associated with additional outfalls, including Outfalls J, K, and L. Inaccessible sections of lines that were not cleaned included the distal ends (between the last manhole and outfall). Following the removal action activities, the cleaned lines were inspected using closed-circuit television surveys, which found that the removal activities were successful for approximately 85 percent of the lines that underwent cleaning (not including distal ends).

The closed-circuit television surveys also documented lines that were cracked, offset, separated, or in otherwise poor condition. Because the storm drain system and its surrounding backfill material at Alameda Point might function as a preferential pathway for migration of chemicals, cracks and leaks in the storm drain lines might also potentially lead to infiltration of contaminated groundwater when the pipelines run through areas of known groundwater contamination, thus resulting in potential transport to San Francisco Bay. The use of closed-circuit television surveys found that most of the storm drain lines leading to Outfalls K and L were in sound condition; however, a small segment of the line that drains to Outfall L was documented to have potential infiltration in the portion between Building 292 and the first catch basin. Although approximately 70 percent of the storm lines that drain to Outfall J were documented as being in sound condition, infiltration of groundwater was observed at four catch basins, potential infiltration was present at three segments, and there were a number of segments for which the condition of the storm sewer was not known. All areas of potential infiltration were located within IR site boundaries. As a result of these findings, two storm drain segments were classified as high priority for repair (areas where infiltration was observed or assumed and located in areas of known groundwater impacts above screening values), three segments were classified as low priority (areas where infiltration was observed or assumed and located in areas of known groundwater contamination below screening values), and all the lines within IR Site 9 were deemed in need of further investigation under the Navy's data gap sampling program (TtEMI 2000b).

A data gap investigation conducted in 2001 (TtEMI 2002) assessed the two pathways of contaminant migration associated with the storm drain system: 1) preferential flow of contaminated groundwater from IR sites to surface water through storm drain bedding material, and 2) preferential flow of contaminated groundwater from IR sites to surface water from infiltration of groundwater through cracks or breaks in the storm drain pipes. To assess pathway number 1, pairs of geotechnical samples were analyzed (each pair consisted of one sample collected from storm drain bedding material and one soil sample collected 10 feet away from the line) at locations where groundwater contaminants were present at concentrations above screening levels. In addition, step-out groundwater samples were collected from bedding material 60 to 100 feet downstream when the results indicated that the bedding material was more porous than the surrounding material and groundwater contaminants were present at concentrations above screening levels. To address pathway number 2, water samples were collected from manholes and catch basins immediately downstream of contaminated groundwater plumes and at the last manhole closest to the storm line outfall. During the data gap investigation, geotechnical sample pairs were collected at IR Sites 4, 9, 13, and 23, which are all located within the Outfall J drainage area. The data gap evaluation concluded that neither the storm drain bedding materials nor the storm drain lines in disrepair near known groundwater contamination are acting as preferred conduits for the transport of known chemicals currently found in soil and groundwater.

In 1996, the Navy performed storm water sampling to support a basewide Storm Water Pollution Prevention Plan as required by the Alameda Point National Pollutant Discharge Elimination System permit. According to the 1996 and 1997 storm water report, water quality problems were not observed to be associated with industrial activities at Alameda Point; however, oil and grease were regularly observed at several outfalls, including Outfall J (TtEMI 2000b).

Since 1972, numerous engineering controls, wastewater treatment systems, and other waste management improvements have been implemented to significantly reduce direct and indirect discharges to the offshore areas through the storm drain system (Battelle et al. 2007). In addition, a storm water pollution prevention program was initiated to ensure that only surface runoff is carried into the offshore areas. Therefore, continuing onshore sources of contaminants to IR Site 24 have been controlled. It is unlikely that the storm drain lines continue to be a primary transport route for contaminants to reach IR Site 24. Most of the contaminated sediment and debris in the storm drain lines from past Navy activities were either removed during the cleaning and removal activities conducted in the 1990s, or may have been flushed to IR Site 24.

2.3 PREVIOUS INVESTIGATIONS AT IR SITE 24

The following sections summarize previous investigations conducted at IR Site 24. Information on the 1996, 1997, 1998, 2005, and 2006 investigations was taken from the RI Report (Battelle et al. 2007). Table 2-1 summarizes the types of sediment samples collected and analyses performed at the site, while Figure 2-2 shows the sediment sampling locations. Complete analytical results reported for the sediment samples can be found in Appendix A of the RI Report (Battelle et al. 2007).

2.3.1 1983 Initial Assessment Study

In 1983, an initial assessment study (IAS) was conducted for all of NAS Alameda to identify sites that posed threats to human health or the environment (Ecology and Environment, Inc. 1983). A review of historical records, aerial photographs, personnel interviews, and field inspections identified areas where hazardous materials were stored, transferred, processed, and/or disposed. Twelve sites (IAS Sites 1 through 12) were identified during the IAS. IAS Site 9 included the piers and open-water areas of IR Site 24. IAS Site 3 was Seaplane Lagoon (IR Site 17), which borders IR Site 24 to the north. Pier 1 marks a porous boundary between IR Sites 17 and 24.

According to the IAS, analysis of sediment samples in the pier areas conducted by the Navy in March 1976 indicated elevated concentrations of lead, zinc, cadmium, copper, volatile organic compounds, and oil and grease. Because the nearly annual dredging of the piers reduced the amount of previously impacted sediment in the area, the report recommended no further investigation for IAS Site 9.

2.3.2 1996, 1997, and 1998 Sediment Investigations

In 1996 and 1998, sediment sampling was performed at Alameda Point locations considered representative of "worst-case" conditions (e.g., the sediment beneath storm drain outfalls and sediment in nondredged areas near the seawall and piers) (Figure 2-2). In 1996, as part of the ecological assessment for offshore areas at Alameda Point, a sediment sample was collected from each of the three storm drain outfalls that discharged into the eastern end of IR Site 24 (SS003, SS004, and SS005, shown on Figure 2-2) (TtEMI 1996). These locations were expected to contain the highest levels of any contaminants discharged in the storm drain system. In 1998, further characterization was conducted at five locations in the northern part of the site (PA01 through PA05, shown on Figure 2-2) (Battelle et al. 2007). The 1996 and 1998 sampling locations were clustered at the eastern edge of IR Site 24, with seven of the eight sediment samples collected between Piers 1 and 2 and one sample collected from storm drain Outfall L (Battelle et al. 2007).

In 1997, the Navy Space and Naval Warfare Systems Center (SPAWAR) (SPAWAR 2000) completed an independent evaluation of IR Site 24 by collecting sediment samples from 31 locations (SS1 through SS31, shown on Figure 2-2). These 1997 samples achieved better spatial coverage of the site than the samples collected in 1996 and 1998; however, the 1997 inorganic chemical data were reportedly not comparable to the 1996 and 1998 data due to the use of a more aggressive extraction procedure (Battelle et al. 2007).

All of the 1996, 1997, and 1998 historical samples were collected from the surface sediment (0 to 2 inches, or 0 to 5 centimeters [cm]). Several metals (i.e., arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, and zinc) and organic constituents (i.e., polycyclic aromatic hydrocarbons [PAHs] and pesticides) were reported in the samples at concentrations above ambient concentrations reported for San Francisco

Bay. Samples collected from Pier 1, near storm drain Outfall J, generally contained the highest concentrations of metals. The 1997 data indicated decreasing PAH concentrations in sediment from east to west along the piers. Total polychlorinated biphenyls (PCBs) exceeded the effects range-median (ER-M) in four of eight samples collected in 1996 and 1998. Total DDx (estimated in the RI Report and for FS purposes as the sum of the pesticides dichlorodiphenyltrichloroethane [DDT], dichlorodiphenyldichloroethene [DDE], and dichlorodiphenyldichloroethane [DDD]) exceeded ambient levels, but was below the ER-M in two samples (SS003 and SS004) collected near storm drain Outfalls J and K in 1996. The sample (SS005) collected near storm drain Outfall L did not have detectable concentrations of DDD, DDE, or DDT (Battelle et al. 2007). Since the 2,4'-DDx compounds were not measured at IR Site 24 prior to 1998, total 4,4'-DDx compounds have been used as a surrogate for total DDx.

2.3.3 2005 and 2006 Remedial Investigation

In 2005, sediment cores were collected as part of the RI from 19 locations at IR Site 24 (PA C-1 through PA C-19, shown on Figure 2-2). Samples were generally collected from the cores at depths of 0 to 2 inches (0 to 5 cm), 2 to 10 inches (5 to 25 cm), 10 to 20 inches (25 to 50 cm), and 20 to 47 inches (50 to 120 cm). Sediment core samples collected from below 50 cm were archived but not analyzed. Sampling locations were selected using both a systematic grid sampling design and a judgment-based sampling design focused on characterizing potential sediment contaminants from the storm drain outfalls. The RI samples collected in 2005 and 2006 were analyzed for PAHs, PCBs, pesticides and metals. The sampling program characterized the area adjacent to the quay wall on the southern side of Pier 3 and the area from the quay wall to the dredged channel. The Navy had hypothesized that the creosote from the pier pilings may have contributed to the PAH contamination found in the sediment; however, a forensic investigation conducted with sediment samples collected in 2005 concluded that the PAH signature was consistent with ambient sources such as motor vehicle exhaust constituents. Additionally, the historically detected PAHs found along the quay wall were assessed further using PAH fingerprinting techniques to identify whether the source of the PAHs was the creosote used in the pier pilings or other potential sources. One core sample was also collected from a reference location outside of the footprint of IR Site 24 to characterize ambient surficial sediment that had not been influenced by the pier pilings or storm drain outfalls (Battelle et al. 2007).

The 2005 RI sampling event also included limited sampling of radionuclides at IR Site 24. The Historical Radiological Assessment (DON 2000) concluded that the berthing of and work on nuclear-powered ships at Alameda Point had no adverse impact on the human population or the ecological environment of the region. An independent study conducted by the U.S. EPA confirmed this finding and consequently, radiological compounds were not identified as chemicals of potential concern at IR Site 24 (U.S. EPA 1989). However, to ensure that all potential radiological issues at the site were addressed, samples for radium analysis were collected at the three 2005 sampling locations (PA C-5, PA C-13, and PA C-16) closest to the storm drain outfalls to determine whether there had been any releases of radium from associated onshore activities (e.g., radium dial painting). Radium-226 was reported above detection limits in all three of these samples, at a maximum of 0.32 picocuries per gram, while radium-228 was not reported in any of these surface sediment samples. Both radium isotopes are naturally occurring. The relatively low and uniform concentrations of these radionuclides observed in the IR Site 24 sediment samples did not indicate a release associated with site activities (Battelle et al. 2007).

Subsequent to the 2005 sampling event, it was determined that additional samples near and beneath the wharf road should be collected. Additional sediment cores were collected in this area from 12 locations (PA C-20 through PA C-31) in September 2006 using the same sampling and analytical methods used during the 2005 sampling event (Figure 2-2). In general, sampling locations were selected using a grid pattern to characterize the sediment shelf area and samples were collected at depths of 0 to 2 inches (0 to 5 cm), 2 to 10 inches (5 to 25 cm), 10 to 20 inches (25 to 50 cm), and 20 to 47 inches (50 to 120 cm) (Battelle et al. 2007). Sediment core samples collected below 50 cm were archived but not analyzed. Table 2-2 summarizes results for selected analytes reported for sediment samples collected at IR Site 24 during the 2005 and 2006 RI sampling events.

2.4 INVESTIGATIONS AT ADJACENT IR SITE 17

Seaplane Lagoon (IR Site 17) adjoins IR Site 24 to the north (Figure 1-2) and is a partially enclosed lagoon that was constructed in the 1930s by dredging a former tidal flat. Pier 1 marks a porous boundary between IR Sites 17 and 24. From the 1940s to 1975, industrial wastewater and storm water generated at the former NAS Alameda were discharged directly into a network of storm drains and carried, in part, into IR Site 17 through storm drain outfalls. During this period, approximately 300 million gallons of untreated industrial wastewater and storm water that reportedly contained heavy metals, solvents, paints, detergents, acids, caustics, mercury, oil and grease, and radium were discharged into Seaplane Lagoon. The storm drain outfalls located in the northeastern and northwestern areas of IR Site 17 were the primary migration pathways of contamination. In 1975, the direct discharge of industrial wastewater through the storm drain network at NAS Alameda was terminated, and since that time, a storm water pollution prevention program has been in place at Alameda Point to ensure that only surface runoff is discharged into the lagoon (DON 2006).

Based on the results of the RI and FS, the Navy, together with the BCT, determined that the northeastern and northwestern areas of IR Site 17 required remedial action. According to the IR Site 17 ROD, the selected remedy is dredging, dewatering, and upland disposal of the contaminated sediment at a permitted off-site waste disposal facility (DON 2006). RGs for impacted sediment at IR Site 17 were documented in the ROD for the primary risk drivers identified in the ecological risk assessment (ERA): cadmium (24.4 milligrams per kilogram [mg/kg]), total PCBs (1.13 mg/kg), and total DDx (0.13 mg/kg) (DON 2006).

Under the Alameda Point General Plan Amendment (City of Alameda 2003), the proposed future use of IR Site 17 includes development of a commercial marina. The area surrounding the site has been proposed as a mixed-use, marina-related district consisting of marina housing, an industrial park, a recreational/commercial area, and a marina waterfront (DON 2006).

2.5 SITE CHARACTERISTICS

This subsection provides an overview of the climate, topography, hydrodynamic setting, geology, hydrogeology, and ecology of IR Site 24.

2.5.1 Climate

The San Francisco Bay Area is characterized by a Mediterranean climate with mild summer and winter temperatures. The mean annual precipitation at Alameda Island is 23 inches, with most of the precipitation generally occurring from October to April. January normally has the greatest average total precipitation of 4.85 inches, while the average precipitation in July is 0.07 inches. Mean yearly low and high temperatures are 52 degrees Fahrenheit (°F) and 67 °F, respectively. The wind direction is predominantly from the west or northwest, with rare occurrences of gale-force or greater winds. Heavy fog that sometimes impairs visibility for navigation occurs on an average of 21 days per year (National Weather Service 2001). January is typically the coldest month, with an average minimum temperature of 44.5 °F and an average maximum temperature of 57.3 °F; September is typically the hottest month with average minimum temperature of 58.3 °F and an average maximum temperature of 74.6 °F (Oakland Museum data from October 1, 1970 to July 31, 2000).

2.5.2 Topography

Alameda Island lies at the base of a gently westward-sloping plain that extends from the Oakland-Berkeley Hills in the east to the shore of the San Francisco Bay in the west. Alameda Island is characterized by a low topographic profile, with surface elevations varying from mean sea level (MSL) to approximately 30 feet above MSL. Alameda Point is located on the western portion of Alameda Island. IR Site 24 is located south of Seaplane Lagoon.

2.5.3 Hydrologic Setting

Construction of NAS Alameda included the filling of tidelands, marshlands, and sloughs with dredged materials from the San Francisco Bay and Oakland Inner Harbor. Based on data collected at a tidal station located on the eastern end of Pier 3 at IR Site 24, tides at the site are semidiurnal (i.e., two high tides and two low tides of variable heights in a 24-hour period). Tides have historically ranged from 2.55 feet below mean lower low water (MLLW) to 3.05 feet above MLLW, with an average diurnal range of 6.60 feet (NOAA 2005). Since IR Site 24 is located within the breakwall of Breakwater Beach, it is protected from large wind-generated waves. In addition, the sediment shelf in the vicinity of the quay wall and beneath the wharf road in the northeastern portion of the site is protected from high-energy forces such as strong currents, boat wakes, propeller scour, keel drag, and large-boat anchoring.

No bathymetric survey data of IR Site 24 are available. The pier area was dredged periodically until 1978 to allow for large naval ships to be docked; berthing areas at the piers were dredged to a depth of approximately 46 feet (14 meters). However, the sediment shelf in the vicinity of the quay wall and beneath the wharf road was not accessible to the dredging equipment (Battelle et al. 2007). The sedimentation rate at the site is currently unknown; the sedimentation rate at nearby IR Site 17 (Seaplane Lagoon) has been estimated at approximately 0.6 to 0.7 inches (1.5 to 1.7 cm) per year (Battelle 2005).

2.5.4 Geology

Alameda Island is located on the east side of the San Francisco Bay. The bay occupies a depression between the Berkeley Hills to the east and Montara Mountain and other mountains to the west. The depression and the hills were formed by two active faults, the San Andreas Fault, west of the San Francisco Bay, and the Hayward Fault, east of the San Francisco Bay. The San Andreas and Hayward Faults are approximately 12 miles west and 5 miles east of the island, respectively.

2.5.4.1 ALAMEDA ISLAND GEOLOGY

Alameda Island and the San Francisco Bay are underlain by metamorphosed sandstone, siltstone, shale, graywacke, and igneous bedrock of Jurassic age, all of which constitute the Franciscan Formation. Alameda Island is underlain by 400 to 500 feet of unconsolidated sediment overlying the Franciscan Formation (Rogers and Figuers 1991).

Alameda Island geology consists of five formations/units described here in order of increasing age:

- Bay Sediment Unit (BSU). The BSU includes an upper and a lower unit. The upper unit is referred to as the Young Bay Mud, which consists of an estuarine deposit of stiff, dark, olive-gray clay with discontinuous silty and clayey sand layers. The lower unit consists of estuarine deposits of silty sand with interbedded layers of fine sand. In the southeastern portion of Alameda Point, the BSU does not occur as a continuous layer.
- Merritt Sand Formation. Beneath most of Alameda Point, the Merritt Sand Formation underlies the BSU. The Merritt Sand Formation is composed of a brown, poorly graded, fine- to medium-grained sand.
- San Antonio Formation. The San Antonio Formation includes an upper and a lower unit. The upper unit is composed of alluvial deposits (interbedded layers of sand and clay), and the lower unit is composed of estuarine deposits. The Yerba Buena Mud (Old Bay Mud), the uppermost member of the lower San Antonio Formation estuarine deposits, is known to be an effective and regionally continuous hydraulic barrier (aquitard) and confining layer above the underlying Alameda Formation (a regional aquifer).

- Alameda Formation. The Alameda Formation, which underlies the San Antonio Formation, consists of an upper unit and a lower unit. The upper unit consists of clay-rich marine deposits, and the lower unit is composed of alluvial deposits. The principal regional aquifer is composed of coarse deposits of the lower portion of the Alameda Formation.
- Franciscan Formation. The Franciscan Formation is composed of metamorphosed sandstone, siltstone, shale, graywacke, and igneous bedrock.

Most of the sedimentary deposits at Alameda Point are overlain by fill material. Most of the land that is now Alameda Point was created by filling the natural tidelands, marshlands, and sloughs with dredge spoils from the surrounding San Francisco Bay, Seaplane Lagoon, and Oakland Inner Harbor (TtEMI 2000a). Fill material thickness generally decreases from west to east across Alameda Point. Up to 40 feet of fill soil is present at the western margin of Alameda Point, where offshore areas were filled to create new land. As little as 3 to 5 feet of fill soil is present at the eastern margin of Alameda Point, where tidal marshes and estuarine channels were filled. The fill material is predominantly poorly graded, fine- to medium-grained sand, with silt and clay.

2.5.4.2 IR SITE 24 GEOLOGY AND SEDIMENT CHARACTERISTICS

In 2005, sediment core samples were collected to a maximum depth of approximately 63 inches (160 cm) from 19 locations in the open areas of IR Site 24. Sediment deposits observed in these cores consisted primarily of dark gray or brown silty clays. In 2006, additional sediment core samples were collected from 12 locations in the vicinity of the quay wall and underneath the wharf road in the northeastern portion of the site. The maximum sampling depth was approximately 63 inches (160 cm). In these samples, sediment deposits were found to be primarily black, fine-grained sands with minor shell fragments and wood chips down to a depth of 20 inches (50 cm) (DON 2006).

2.5.5 Hydrogeology

This subsection discusses hydrogeology at Alameda Island, Alameda Point, and IR Site 24.

2.5.5.1 REGIONAL HYDROGEOLOGY

Alameda Island is underlain by two primary aquifers, the shallow Merritt Sand aquifer that yields saline water and the deeper Alameda aquifer that yields freshwater. These aquifers are separated by the San Antonio aquitard, which is 55 to 90 feet thick beneath Alameda Point.

The Merritt Sand Formation is a semiconfined aquifer with potentiometric head elevations from 0 to 6 feet above MSL at Alameda Island (TtEMI 1999a,b). Regionally, groundwater recharge occurs in outcrop areas of the Merritt Sand located in the southeastern portion of Alameda Point, as well as east of Alameda Point on Alameda Island. Sources of this groundwater recharge include irrigation, precipitation, and possibly leaking water-supply lines, sewer lines, and storm drains (TtEMI 1999a,b). There is no hydraulic connection between the shallow aquifer systems on Alameda Island

and the Oakland mainland because shallow units have been truncated by the channel of the Oakland Inner Harbor.

The Alameda aquifer is the principal regional aquifer. Depth to the top of the Alameda aquifer ranges from 180 feet below ground surface (bgs) at Alameda Point to 220 feet beneath the surface of the sediment in Oakland Inner Harbor. The thickness of the formation is between 230 and 800 feet (Hickenbottom and Muir 1988).

2.5.5.2 HYDROGEOLOGY AT ALAMEDA POINT AND IR SITE 24

There are no naturally occurring streams at Alameda Point, and the only naturally occurring ponds are at the southwestern end of the island (IR Site 2). Therefore, precipitation primarily evaporates into the atmosphere, runs off through the storm drain network, or infiltrates to groundwater.

Previous studies indicated that the groundwater table across Alameda Point is encountered at depths of 3 to 8 feet bgs within the fill layer. Groundwater recharge occurs from infiltrating precipitation over unpaved areas in Alameda Point.

At Alameda Point, the first water-bearing zone (FWBZ) is an unconfined aquifer existing within the fill layer, and the second water-bearing zone (SWBZ) is a semiconfined or unconfined aquifer that occurs within the Merritt Sand Formation and the Upper San Antonio Formation. The SWBZ is found only in the portions of Alameda Point where the overlying BSU is present and where it consists of low-permeability materials, thereby allowing the BSU to act as a hydraulic barrier between the FWBZ and SWBZ (TtEMI 2000a).

In areas where the BSU occurs as a continuous layer, such as in the western and central portions of Alameda Point, the FWBZ exists primarily within a thin layer of fill material. The SWBZ extends from the Merritt Sand Formation through to the top of the Yerba Buena Mud (Lower San Antonio Formation), which functions as a confining unit below the SWBZ (TtEMI 2000a).

In areas where the BSU does not occur as a continuous layer, such as in the southeastern portion of Alameda Point that includes IR Site 24 and adjacent areas east of the site, the FWBZ occurs within the thin layer of fill material as well as within the Merritt Sand and the Upper San Antonio Formations (Hickenbottom and Muir 1988, TtEMI 1999a). The FWBZ extends vertically to the top of the Yerba Buena Mud, which acts as the confining layer below the FWBZ. Groundwater in the FWBZ generally flows to the west-southwest towards Seaplane Lagoon and San Francisco Bay in the southeastern portion of Alameda Point near IR Site 24. The SWBZ does not exist in the southeastern portion of Alameda Point (TtEMI 2000a).

2.5.6 Ecology

The land of Alameda Point includes several habitat areas: barren, urban, nonnative grassland, coastal scrub, and wetlands. Barren and urban habitat generally supports few wildlife species, due to human disturbances and limited vegetation. Nonnative grassland habitat offers shelter, forage, and nesting opportunities for a variety of animal species. The coastal scrub habitat on Alameda Point occurs as a disturbed habitat with mixed scrub vegetation and nonnative grassland. Several saline emergent wetland habitat areas, also known as salt marshes, occur at Alameda Point. The largest are the West Beach Landfill Wetland, which is located at the western end of Alameda Point, and the Runway Wetland, which is located along the southern margin of Alameda Point near Seaplane Lagoon (PRC 1994). Several seasonal wetlands were identified in the western portion of Alameda Point and along some of the runway margins (TtFW 2004, EDAW 2005).

Estuarine habitat of San Francisco Bay exists in the intertidal and subtidal zones along the shoreline of Alameda Point and nearby areas, including Oakland Inner Harbor and Seaplane Lagoon. The main body of San Francisco Bay is adjacent to the southern margin of Alameda Point.

IR Site 24 is located in San Francisco Bay in the southeastern portion of Alameda Point. At IR Site 24, aquatic vegetation includes various marine algae and phytoplankton. The estuarine habitat supports numerous pelagic (in the water column) and benthic (in or on the sediment) invertebrates, including polychaete worms, amphipod and shrimp crustaceans, clams, snails, and crabs. Representative fish species include topsmelt (*Atherinops affinis*), anchovy (*Engraulis mordax* and *Anchoa compressa*), surfperches (*Embiotocidae*), and gobies (*Gobiidae*). Numerous other fish species are also present. Fish and invertebrates occurring in the estuarine habitat represent a food source for many birds, including the California least tern (*Sterna antillarum browni*), California brown pelican (*Pelecanus occidentalis californicus*), western grebe (*Aechmophorus occidentalis*), and western snowy plover (*Charadrius alexandrinus nivosus*). The marine mammals California sea lion (*Zalophus californianus*) and harbor seal (*Phoca vitulina*) may forage in the vicinity of IR Site 24.

Special-status species, those species classified as threatened, endangered, or species-of-concern by state or federal agencies, are known to occur in the central portion of San Francisco Bay in the vicinity of IR Site 24. These species include steelhead (*Oncorhynchus mykiss*), Chinook salmon (*Oncorhynchus tshawytscha*), western snowy plover, California least tern, double-crested cormorant (*Phalacrocorax auritus*), California brown pelican, American peregrine falcon (*Falco peregrinus anatum*), California sea lion, and harbor seal. None of these species uses IR Site 24 for breeding or nesting; however, some use adjacent areas for nesting.

Wetlands, eelgrass beds, and the paved runway used for least tern nesting are considered sensitive habitats. The wetlands occur in the western portion of Alameda Point. The eelgrass beds are located in the shallow water off the west end of Alameda Point. The California least tern nesting site is on the runway in the central portion of the airfield in Transfer Parcel FED-1A.

2.6 CONCEPTUAL SITE MODEL

The conceptual site model provides a summary of the nature and extent of contaminants in sediment and fate-and-transport mechanisms at IR Site 24. Figure 2-3 depicts the CSM included in the RI Report (Battelle et al. 2007).

2.6.1 Nature and Extent of Contamination

Analytical results reported for sediment samples were compiled and used to characterize the nature and extent of contamination at IR Site 24 (Battelle et al. 2007). Data included results from analyses of surface sediment samples collected in 1996, 1997, and 1998, and surface and subsurface sediment samples collected in 2005 and 2006.

Concentrations of most inorganic constituents (metals) and organic chemicals in sediment in the open-water portions of IR Site 24 were low and typically did not exceed ecological screening benchmark values such as the ER-M. Concentrations of inorganic and some organic constituents were higher in the sediment shelf near shore and beneath the wharf road between storm drain Outfalls J and K. This section summarizes the nature and extent of contamination in sediment at IR Site 24. Table 2-2 presents the 2005 and 2006 RI sediment results for the COPECs. The range of COPEC concentrations is presented in Table 2-3. A full discussion is presented in the RI Report (Battelle et al. 2007).

2.6.1.1 METALS

Analytical results reported for surface sediment samples collected during the 1996, 1997, and 1998 sampling events showed that cadmium, chromium, copper, mercury, nickel, and silver were reported at least once at concentrations above their corresponding ER-Ms. With the exception of nickel, all ER-M exceedances were confined to samples collected from the northeastern corner of IR Site 24 between Piers 1 and 2. Nickel was the only metal reported at concentrations above the ER-M value in all three sampling events. Nickel exceeded its ER-M value in all but two samples; however, it must be noted that the ambient upper tolerance limit for nickel in San Francisco Bay is more than twice the nickel ER-M value (Battelle et al. 2007).

The 2006 sampling event was conducted near the shoreline and beneath the wharf road, an area not sampled during previous investigations. Analytical results reported for sediment samples collected during this event showed that concentrations of cadmium, chromium, lead, mercury, nickel, selenium, silver, and zinc exceeded their respective ER-Ms in at least one surface sediment sample from beneath the wharf road (Table 2-2). Concentrations of cadmium, chromium, lead, mercury, selenium, and silver were reported to be highest in the sediment samples closest to Pier 1 (near storm drain Outfall J), with concentrations declining toward Pier 2. Arsenic and nickel concentrations were not elevated or only slightly elevated in samples from the northeastern corner compared to the rest of IR Site 24. The zinc concentration was elevated in one surface sediment sample adjacent to storm drain Outfall K, but zinc was otherwise rather uniformly distributed over the rest of the site (Battelle et al. 2007).

Subsurface sediment data were available for 2005 and 2006 samples only; these samples were collected at two depth intervals: 2 to 10 inches (5 to 25 cm) and 10 to 20 inches (25 to 50 cm) below the surface. In the 2005 subsurface samples collected in open-water areas at IR Site 24, metals concentrations were generally uniform with depth, and all metals concentrations were below the ER-M value except for nickel and silver; nickel concentrations throughout the open-water areas were not statistically different from background (Battelle et al. 2007). Concentrations of metals reported in the 2006 samples collected underneath the wharf road were higher across both depth intervals than in the 2005 samples collected in the open-water areas of IR Site 24. Analytical results showed that the concentrations of several metals (cadmium, chromium, lead, and mercury) were highest in the subsurface sediment samples collected in 2006 at sampling locations adjacent to storm drain Outfall J, in the vicinity of the quay wall in the northeastern corner of the site. Chromium, lead, and mercury had maximum observed concentrations in the 2-to-10-inch (5-to-25-cm) depth interval, while the maximum concentration of cadmium was reported in the 10-to-20-inch (25-to-50-cm) depth interval. Copper and antimony had maximum observed concentrations at the 2-to-10-inch (5-to-25-cm) depth interval at a location eastward of the quay wall adjacent to storm drain Outfall K. Concentrations of selenium were highest in the surface sediment and appeared to decrease with depth, while concentrations of arsenic and nickel were uniform across depth intervals (Battelle et al. 2007).

2.6.1.2 POLYCYCLIC AROMATIC HYDROCARBONS

At IR Site 24, PAH concentrations exceeded their respective ER-M values in 11 surface sediment samples collected during the 1996, 1997, and 1998 sampling events. During the 1996 sampling event, the majority of the PAHs exceeded their ER-M values at the southernmost storm drain outfall locations (Outfalls K and L). PAHs in the 1997 samples collected in offshore areas generally had similar concentrations to the 1996 storm drain outfall samples. Concentrations of PAHs in the 1998 samples collected from the undredged areas near the seawall and piers were much lower than the PAH concentrations in the 1996 storm drain outfall and 1997 offshore samples, but several ER-Ms were exceeded for PAHs in these sediment samples (Battelle et al. 2007).

PAH concentrations were higher in surface sediment samples collected in 2006 beneath the wharf road than in the 2005 samples collected from the open-water portions of the site. PAHs were not reported at concentrations exceeding the screening benchmark ER-M values in any of the surface sediment samples collected in the open-water areas during the 2005 sampling event. PAH concentrations in the 2006 surface sediment samples collected underneath the wharf road exceeded ER-M values at several locations, with the highest concentrations observed at locations PA-22 and PA-23 in the northeastern corner of the site (Battelle et al. 2007).

Subsurface data for PAHs were available for 2005 and 2006 samples only. Concentrations of PAHs were relatively uniform or decreased with depth (Battelle et al. 2007). At 18 of the 19 sampling locations in the open-water portion of IR Site 24, the surface sediment samples contained the highest concentrations of high-molecular-weight PAHs (Table 2-2).

Low-molecular-weight PAH concentrations were highest in the surface interval for all seven 2005 sampling locations. For the 2006 samples, the highest concentrations of high-molecular-weight PAHs were reported in the surface sediment samples collected from 8 of the 12 locations and low-molecular-weight PAH concentrations were highest in the surface sediment samples collected from 7 of the 12 sampling locations.

2.6.1.3 POLYCHLORINATED BIPHENYLS AND PESTICIDES

The 1996 samples (SS03 and SS04) collected near storm drain Outfalls J and K and two 1998 surface sediment samples (PA01 and PA02) collected near these storm drain outfalls had total PCB concentrations exceeding the ER-M value for total PCB. The total PCB concentration in the surface sample collected in 2005 from location PA C-16 in the northeastern section of the site exceeded the ER-M. Concentrations of total PCBs reported for the rest of the samples collected in the open-water portion of IR Site 24 during all sampling events were relatively uniform and did not exceed the total PCB ER-M value (Battelle et al. 2007). Total PCB concentrations exceeded the ER-M for total PCBs in 10 of the 12 surface sediment samples collected in the vicinity of the quay wall in 2006 (PA C-20 through PA C-29) (Table 2-2).

There was little difference in mean concentrations of total PCBs across depth intervals in the open-water portion. Only a single 2005 surface sample (PA C-16) contained PCB concentrations exceeding the ER-M value, and concentrations in both subsurface intervals at that location also exceeded the ER-M value (Table 2-2). In the 2006 samples, subsurface sediment samples collected from 9 of 12 locations had total PCB concentrations exceeding ER-M values; seven of the nine locations (PA C-20 through PA C-24, PA C-26, and PA C-27) were located between storm drain Outfalls J and K (Battelle et al. 2007).

Pesticides were analyzed during the 1996 and 1998 sampling events and were seldom detected. The 1997 samples were not analyzed for pesticides. In 1996, concentrations of alpha-chlordane and 4,4′-DDT exceeded their ER-M values in surface sediment samples from two locations (SS003 and SS004) near storm drain Outfalls J and K in the northeastern portion of the site, but did not exceed the ER-Ms in any of the 1998 and 2005 surface samples. In 1998, no pesticides were reported at concentrations exceeding the ER-Ms in the surface sediment samples collected from the undredged areas near the seawall and piers (Battelle et al. 2007).

Dieldrin, gamma-chlordane, 4,4′-DDD, and 4,4′-DDT exceeded their respective ER-M values in at least one surface sediment sample beneath the wharf road in 2006, but these pesticides were not detected at concentrations exceeding the ER-M values in any of the surface sediment samples collected in the open-water areas during the 2005 sampling event (Battelle et al. 2007).

Alpha-chlordane, gamma-chlordane, dieldrin, and DDx compounds were the only pesticides reported in the subsurface sediment samples. The maximum concentrations of alpha-chlordane, dieldrin and DDx compounds reported in subsurface samples collected during the 2005 and 2006 sampling events occurred in the 2-to-10-inch (5-to-25-cm) depth interval at locations PA C-21 and PA C-24, near storm drain Outfall J. The highest detected gamma-chlordane concentration was reported in the subsurface sample collected at a depth interval of 10 to 20 inches (25 to 50 cm) at location PA C-25, near storm drain Outfall K.

2.6.2 Fate-and-Transport Mechanisms

The primary sources of contamination to sediments at IR Site 24 include historical wastewater and surface runoff discharge through the storm drain system. There are three storm drain lines leading to Outfalls J, K, and L that currently discharge into the site. The storm drain system served as a primary transport route for chemicals and surface runoff to the site (Battelle et al. 2007).

Sediment is the primary medium for human and ecological risk exposures at IR Site 24. Previous investigations indicated that metals, PAHs, PCBs, and pesticides are present in sediment, with the highest concentrations primarily reported in samples collected in an area located in the northeastern section of the site and beneath the wharf road between storm drain Outfalls J and K.

The fate and transport of metals, PAHs, PCBs, and pesticides in sediment at IR Site 24 are largely affected by the movement of sediment particles controlled by natural forces such as tidal currents and man-made activities such as dredging and boating. Resuspension and transport of impacted sediment are expected to be minimal at IR Site 24 due to the absence of high-energy forces such as strong currents, significant wave action, boat wakes, keel drag, and propeller scour.

Surface water is not considered a medium of concern at IR Site 24 because metals, PAHs, PCBs, and pesticides are relatively insoluble, and partitioning from sediment to surface water is low. Hydrophobic, nonpolar organic contaminants such as PCBs and pesticides tend to be adsorbed to fine-grained sediment, which is present at the site. Adsorption onto sediment particles limits the degree to which dissolution in and contamination of overlying water occurs. Although some metals (e.g., cadmium) in the sediment may be released to the water column under changing reduction-oxidation (redox) conditions (e.g., introduction of oxygen-rich water), the San Francisco Bay currents and tidal action would result in dilution of dissolved chemical concentrations in surface water (Battelle et al. 2007).

2.7 RISK ASSESSMENT ACTIVITIES

A human health risk assessment (HHRA) and an ERA were performed to assess potential impacts on human and environmental receptors from exposure to chemicals in sediment at IR Site 24. This section summarizes the results of the HHRA and ERA presented in the RI Report (Battelle et al. 2007).

2.7.1 Human Health Risk Assessment

Sediment is the primary exposure medium at IR Site 24. As described in Section 2.2, the site is dominated by three piers consisting of concrete platforms supported by concrete and wooden pilings. Access to the sediment shelf beneath the wharf road from the pier is limited and difficult. Access to that area by boat is blocked by pier pilings and cross members; only one entrance is available and this entrance could easily be closed. Furthermore, access to this area is possible only at low tide. Due to the total water depth at the pier face (approximately 12 to 28 feet), it is not possible to walk under the wharf road from the pier. Sediment observed at low tide was primarily sand covering rip rap; areas of sand covering mud were always submerged. As a result, a habitat that could support clam beds (i.e., intertidal mudflats) is not present and therefore a resident shellfish population is not likely. A small population of mussels has been noted on the pier structures; however, the limited and difficult access to water and shoreline reduces the likelihood that humans could harvest sufficient numbers of these mussels to make shellfish consumption a significant exposure pathway. During the 2006 sampling event, there was no evidence of any shellfish collection activities in the area (e.g., fishing gear, scrape marks on pilings, debris, etc.). There are no plans to remove the piers at IR Site 24, and it has been proposed that future site use would consist of docking large-scale ships such as ferries, cruise ships, or historical landmark vessels (EDAW 1996). These activities would further limit the likelihood of individuals accessing the area for recreational purposes. Based on this information, no complete human-health exposure pathways were identified for shellfish at IR Site 24 (Battelle et al. 2007).

With respect to consumption of sport fish, individuals have been reported to have fished from the piers. The limited shallow habitat makes it unlikely that there is a significant number of resident fish species; therefore, fish targeted by anglers at the site are likely to be sport fish with relatively large foraging ranges, making it difficult to apportion site-specific risks. However, to evaluate the potential risks at IR Site 24 as part of the RI, fish tissue concentrations were modeled based on the sediment exposure point concentrations (EPCs) and the BAFs developed in the RI Report and compared to tissue concentrations reported at reference locations. In general, the modeled fish tissue concentrations were lower than or similar to those reported for reference locations. Therefore, the potential risks to human health due to consumption of fish were determined to be low and comparable to risk associated with reference locations and no further evaluation was recommended in the RI Report (Battelle et al. 2007).

2.7.2 Ecological Risk Assessment

To evaluate potential risks to ecological receptors, a tiered process was used during the RI that was consistent with U.S. EPA and Navy guidelines. In the first tier, a screening-level ERA was conducted (encompassing Steps 1 and 2 of the U.S. EPA guidance), which consisted of a preliminary problem formulation and a screening-level dose assessment using conservative assumptions. The second tier, or baseline ERA (Steps 3a, 3b, and 4 through 7 of the U.S. EPA guidance), used the results of the screening-level ERA to refine the problem formulation and to further evaluate the potential for adverse effects to ecological receptors of concern by using more site-specific data, when available. Three assessment end points were evaluated in the ERA: 1) risks to benthic invertebrates, 2) risks to fish, and 3) risks to fish-eating (e.g., cormorant) and benthic-feeding (e.g., surf scoter) birds, including potential special-status species (Battelle et al. 2007).

As part of the first-tier activities, chemical concentrations in sediment were compared to conservative, direct-contact toxicity-screening benchmarks. A majority of the chemicals were brought forward to the site-specific baseline ERA. Additionally, numerous analytes detected in sediment had no benchmarks for comparison. Therefore, benthic invertebrates and fish were recommended for further evaluation as receptors in the site-specific baseline ERA. Similarly, the food-chain screening-level risk estimate for birds also indicated that a number of chemicals needed to be evaluated further in the baseline ERA. In the baseline risk assessment, the preliminary problem formulation and then the measurements of exposure and effects were refined and integrated into a characterization of risk that included the potential uncertainties associated with the assessment (Battelle et al. 2007).

For all of the assessment end points evaluated at IR Site 24, most of the areas in the site pose acceptable ecological risks. There was an indication of the potential for adverse effects to the ecological receptors assessed in a small area in the northeastern corner of the site, specifically the sediment shelf eastward of the quay wall and beneath the wharf road between storm drain Outfalls J and K. However, due to uncertainties identified in the baseline ERA, it was not possible to conclude definitively whether this small sediment shelf area presents an unacceptable risk to the three assessment end points evaluated (Battelle et al. 2007). The RI Report identified the key risk drivers as cadmium, lead, total DDx, and total PCBs.

The most significant uncertainties identified for the baseline ERA were associated with the exposure and effects assessment. From an exposure perspective, site-specific tissue data were limited (bivalves) or lacking (fish). To address this uncertainty and to provide a conservative estimate of exposure, the higher of either a measured or a modeled concentration was used. Additionally, it was assumed that all receptors had equal access to all areas of the site. However, due to the large ships berthed at the site, and the fact that the highest sediment concentrations were limited in area and generally restricted to the area beneath the wharf road between storm drain Outfalls J and K, an assumption of equal access overestimates actual exposure. From a toxicity perspective, the most significant source of uncertainty was the benthic invertebrate assessment end point. Due to confounding factors associated with the historical bioassays and the lack of bioassay data from the area of highest sediment concentrations, it is unknown whether the sediment at the site is actually toxic to benthic invertebrates (Battelle et al. 2007). For the purposes of this FS, the Navy has conservatively assumed that shallow sediment in the vicinity of storm drain Outfall J extending west from the wharf road to the sediment shelf poses potentially unacceptable ecological risks to benthic organisms, fish, and fish-eating birds.

2.8 CONCLUSIONS AND RECOMMENDATIONS FROM THE REMEDIAL INVESTIGATION

Concentrations of most metals and organic chemicals in sediment in the open-water portions of IR Site 24 were low and generally did not exceed ER-M values. Total PAH, pesticide, total PCB, and several metal concentrations exceeded ER-M values, primarily in the 2006 sediment samples collected in the sediment shelf located in the vicinity of the quay wall and beneath the wharf road between storm drain Outfalls J and K. While samples collected during the 2006 sampling event from this sediment shelf have the highest concentrations of chemicals, there is no evidence that the sediment in this area is acting as a secondary source to sediment in the open-water portions of IR Site 24. A review of the spatial distribution of the analytical results reported for the 2006 samples revealed that elevated concentrations of metals, PAHs, and pesticides are co-located with the PCB exceedances in sediment samples collected beneath the wharf road.

The HHRA did not identify complete exposure pathways for human receptors due to the limited habitat for shellfish at the site, as well as the limited and difficult access to the water and shoreline for recreational and shellfish harvesting purposes. The key risk drivers for the ERA were cadmium, lead, total DDx, and total PCBs in the northeastern corner of IR Site 24. The ERA concluded that risks were acceptable over the majority of the site, and that the only area with a potential for adverse ecological impacts was the sediment shelf in the northeastern corner of the site. The potential risk in this area is expected to be limited due to the small size of the area and the location behind the quay wall and beneath the wharf road, where access by ecological receptors is likely to be minimal. Based on the ERA results, the RI Report recommended that an FS be conducted for the area located in the sediment shelf in the vicinity of the quay wall and beneath the wharf road between storm drain Outfalls J and K (Battelle et al. 2007).

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Section 3
REMEDIAL ACTION OBJECTIVES

U.S. EPA guidance (U.S. EPA 1988) defines RAOs as medium-specific (e.g., sediment, soil, groundwater, or air) or operable unit (OU)-specific goals for protecting human health, welfare, and the environment. These objectives focus the FS and define the scope of potential remediation activities, thereby guiding the development and evaluation of remedial alternatives that are consistent with anticipated future use.

This section presents preliminary RAOs for impacted sediment associated with IR Site 24 at Alameda Point. RAOs include preliminary RGs for COPECs, which are a quantifiable means of identifying areas where remediation would be performed. Factors considered in determining RAOs include affected media, COPECs, existing and potential receptors and exposure pathways, and ARARs.

General response objectives are used to identify RAOs. The general response objective for IR Site 24 is to protect ecological receptors from unacceptable exposure to COPECs through exposure to sediments or consumption of contaminated prey.

The IR Site 24 RI Report concluded that no complete human-health exposure pathways were identified for IR Site 24 (Battelle et al. 2007). Potential risks to human health related to fish consumption were determined to be low and comparable to risks under reference conditions. In addition, the IR Site 24 RI Report concluded that the majority of the site area poses acceptable ecological risks. Only the sediment shelf located in the vicinity of the quay wall in the northeastern corner of the site (Figure 3-1) shows a potential for adverse ecological risks. Therefore, based on the IR Site 24 RI Report's ERA conclusions and recommendations, an FS was recommended for the northeastern sediment shelf area in the vicinity of the quay wall and beneath the wharf road between storm drain Outfalls J and K (Battelle et al. 2007). This area, shown on Figure 3-1, is the subject of this FS Report, and will be referred to throughout the remainder of this FS Report as the area of ecological concern (AOEC). Therefore, this FS addresses only potentially unacceptable ecological risks in the AOEC at IR Site 24.

3.1 AFFECTED MEDIA AND CHEMICALS OF CONCERN

Previous investigations at Alameda Point have shown that sediment at IR Site 24 has been impacted by metals, pesticides, and PCBs (Battelle et al. 2007). ERA results indicated that potential exposure to these chemicals in sediment in the AOEC would present the primary ecological risk at IR Site 24. Surface water is not considered a medium of concern because the COPECs are primarily associated with sediments, tend to adsorb to fine-grained sediment particles, and are relatively insoluble. In addition, water circulation due to tides and other bay currents would have caused rapid dilution and/or dispersion of surface water concentrations (Battelle et al. 2007). No continuing sources of sediment contamination from land (such as flow of contaminated groundwater or ongoing discharge of contaminated sediment) have been identified at IR Site 24. Therefore, sediment is the only medium of concern for this FS Report.

For all of the assessment end points evaluated at IR Site 24, most of the areas at IR Site 24 pose acceptable ecological risks. The only area that shows any indication of a limited potential for adverse effects is the AOEC depicted on Figure 3-1. The potential for unacceptable ecological risk in the AOEC is expected to be limited due to the small size of the area and the location of the sediment shelf under the wharf road, where exposure to receptors is likely to be minimal (Battelle et al. 2007).

The RI Report (Battelle et al. 2007) recommended that the FS address the area between Outfall locations J and K as represented by sampling locations C-21, C-23, C-24, C-26, and C-27. These sampling locations are along the quay wall and beneath the wharf road between Outfalls J and K. A comparison of preliminary RGs developed in the FS to the IR Site 24 sediment data indicated that concentrations of chemicals of concern (COCs) exceed the preliminary RGs at sampling locations C-20, C-21, C-23, and C-24, but not at locations C-26 and C-27. Therefore, the AOEC and sediment volume estimates are based on sampling locations C-20, C-21, C-23, and C-24.

IR Site 24 is located adjacent to IR Site 17 (Seaplane Lagoon). Under the proposed future reuse plan, IR Site 24 will be developed as a commercial marina along with the adjacent Seaplane Lagoon site, with no plans to remove the piers or the wharf road. The area south of Pier 3 is anticipated to be transferred to the California Department of Fish and Game as a marina (Battelle et al. 2007).

Sediment COCs were identified at IR Site 24 based on sediment sampling conducted during the RI and previous investigations (Battelle et al. 2007). COCs for IR Site 24 are likely related to historical stormwater discharges, but no discrete source was identified. COCs were reported in sediment in the AOEC at concentrations potentially contributing to ecological risk. The following COCs in sediment were identified as the primary contributors to potential ecological risk at IR Site 24, and are addressed in this FS Report:

- cadmium
- lead
- total DDx
- total PCBs

3.2 POTENTIAL RECEPTORS AND EXPOSURE PATHWAYS

The RI Report (Battelle et al. 2007) described potential risk for ecological receptors exposed to surface sediment at IR Site 24. The benthic invertebrate community (principally invertebrates that live in or on the sediment at the bay bottom) is potentially at risk from sediment contaminants due to direct contact and ingestion exposure. Three representative bird receptors (surf scoter, double-crested cormorant, and California least tern) are potentially at risk from cadmium, lead, total DDx, and total PCBs due to ingestion of contaminated food and incidental ingestion of surface sediment. The RI Report did not indicate potential risk to fish receptors due to surface sediment exposures. However, subsurface sediment, if exposed is also associated with potential risk to the benthic community, fish, and birds. The RI Report noted that the receptors were likely only at risk due to sediment concentrations in the AOEC.

The potential ecological risk described in the RI Report was associated with uncertainties regarding whether sediment in the AOEC presents an unacceptable risk to ecological receptors. The most significant sources of uncertainty were the lack of separate bioassay data for the AOEC, the confounding factors (e.g., porewater ammonia concentrations and toxicity observed at the reference stations) associated with the existing bioassay data for IR Site 24, the lack of site-specific fish tissue data, and the small number of site-specific clam tissue data (Battelle et al. 2007).

The RI Report addressed some of these uncertainties by using data from IR Site 17 (Seaplane Lagoon), the adjacent sediment site. Sediments at Seaplane Lagoon represent a similar ecological habitat with similar receptors and similar COCs (Battelle et al. 2004). Water depth at Seaplane Lagoon and IR Site 24 ranges from 0 to approximately 20 feet below MLLW and 0 to approximately 28 feet below MLLW, respectively. Circulation at Seaplane Lagoon is expected to be somewhat less than IR Site 24 due to the semi-enclosed nature of the lagoon. Seaplane Lagoon and IR Site 24 are separated by a pier (Pier 1) constructed on pilings, which allows water exchange between the two sites. COCs were present at similar concentrations at Seaplane Lagoon and IR Site 24 (Table 3-1). Ecological risks for Seaplane Lagoon and IR Site 24 were similarly evaluated using three assessment end points: benthic invertebrate community, fish, and avian wildlife. For the purposes of this FS, Seaplane Lagoon data were used to further address uncertainties of the ERA and to develop preliminary RGs.

The RI Report for IR Site 24 indicated potential risk for the benthic invertebrate community at the AOEC, but uncertainties prohibited a clear determination of actual risk (Battelle et al. 2007). However, at Seaplane Lagoon, the bioassay data did not indicate potentially unacceptable risk to the benthic invertebrate community from sediment COC concentrations (Battelle et al. 2004). Since the COC concentrations and the ecological receptor (benthic invertebrate community) were similar at Seaplane Lagoon and IR Site 24, for the purposes of this FS, the potential risk to the benthic community at IR Site 24 is considered low. Therefore, benthic invertebrates were not selected as a receptor for development of a preliminary RG.

Fish receptors were considered at potential risk from sediment cadmium, based on hazard quotient (HQ) values exceeding 1 (rounded to one significant figure) for subsurface sediment (2 to 10 inches [5 to 25 cm] below the sediment surface) (Battelle et al. 2007). This potential risk to fish is only expected to occur if the exposure pathway is complete (e.g., a scenario where the surficial sediments were removed).

Three avian species were evaluated for potential ecological risk from exposure to sediment COCs: the California least tern, the surf scoter, and the double-crested cormorant. The avian receptors were considered to be at potential risk due to sediment cadmium, lead, total DDx, and total PCBs based on HQ values exceeding 1. Based on a review of the HQ values and on its endangered-species status, the least tern is considered the most sensitive of the modeled ecological receptors. The least tern was also considered the most sensitive receptor at Seaplane Lagoon (Battelle et al. 2004, Battelle 2005).

With respect to consumption of sport fish, individuals have been reported to have fished from the piers. The limited shallow habitat makes it unlikely that there is a significant number of resident fish species; therefore, fish targeted by anglers at the site are likely to be sport fish with relatively large foraging ranges, making it difficult to apportion site-specific risks. However, to evaluate the potential risks at IR Site 24 as part of the RI, fish tissue concentrations were modeled based on the sediment exposure point concentrations (EPCs) and the BAFs developed in the RI Report and compared to tissue concentrations reported at reference locations. In general, the modeled fish tissue concentrations were lower than or similar to those reported for reference locations. Therefore, the potential risks to human health due to consumption of fish were determined to be low and comparable to risk associated with reference locations and no further evaluation was recommended in the RI Report (Battelle et al. 2007).

Based on the findings from the RI Report (Battelle et al. 2007), the RAOs for IR Site 24 include:

- protection of forage fish from unacceptable contact or ingestion exposure to COCs in sediment;
- protection of piscivorous and benthic-feeding birds, including least terns, surf scoters, and double-crested cormorants, from unacceptable exposure to sediment cadmium, lead, total DDx, and total PCBs through ingestion of contaminated prey; and
- reduction of potential biomagnifications of total PCBs in organisms higher in the food chain.

3.3 POTENTIAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

CERCLA Section 121(d) requires that final remedial actions attain (or the ROD must justify the waiver of) any federal or more stringent state environmental standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate. The evaluation of ARARs for this FS Report is presented in Appendix A.

The identification of ARARs is a site-specific determination and involves a two-part analysis: first, a determination of whether a given requirement is applicable; then, if it is not applicable, a determination of whether it is relevant and appropriate. According to 40 C.F.R. § 300.5, applicable requirements are those standards of cleanup or control and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. A requirement is applicable, and therefore an ARAR, if the prerequisites of the standard show a direct correspondence to site conditions. Relevant and appropriate requirements are those standards, criteria, or limitations promulgated under federal or state law that, while not applicable, nevertheless address problems or situations sufficiently similar to those encountered at a CERCLA site to make their use well suited to that particular facility. A requirement must be determined to be both relevant *and* appropriate in order to be considered an ARAR. If a requirement satisfies both of these tests, it must be complied with in the same manner as an applicable requirement (U.S. EPA 1988).

As the lead federal agency for environmental cleanup activities at Alameda Point, the Navy has primary responsibility for identification of potential federal ARARs for remediation at IR Site 24. State agencies are responsible for identifying state ARARs; the lead state agency in California is the DTSC. Identification of potential state ARARs for this FS Report was initiated through a Navy request to DTSC (Attachment A2 in Appendix A). The Navy reviewed and identified the state ARARs that apply to IR Site 24 using basewide ARARs that were received from the state in a letter dated November 13, 1996 (Attachment A1 in Appendix A). DTSC has reviewed the ARARs identified for IR Site 24 and concurs with them.

ARARs are generally separated into three categories: chemical-specific, location-specific, and action-specific. Chemical- and location-specific ARARs are discussed in Sections 3.3.1 and 3.3.2, respectively. Action-specific ARARs are technology- or activity-based requirements or limitations on remedial actions and are identified in Section 6 of this FS Report in association with the detailed analysis of the remedial alternatives.

3.3.1 Potential Chemical-Specific ARARs

Chemical-specific ARARs are numerical standards that establish acceptable levels of risk for individual chemicals in affected environmental media. Such ARARs may be derived from the application of health- or risk-based methodologies to site-specific conditions.

Sediment is the only medium of concern addressed in this FS Report. In addition to potential chemical-specific ARARs for sediment, potential chemical-specific ARARs for surface water are also summarized in this subsection because surface water may also be affected by the IR Site 24 remedial action alternatives.

3.3.1.1 SEDIMENT

Based on ERA results presented in the RI Report, the following chemicals were identified as COCs for sediment in the AOEC at IR Site 24: cadmium, lead, total DDx, and total PCBs. The RAOs presented in Section 3.2 are intended to mitigate potentially unacceptable ecological exposure to surface sediment. In addition to this narrative objective, remedial response actions at IR Site 24 are affected by potential state and federal chemical-specific ARARs.

No potential chemical-specific ARARs have been identified for the establishment of cleanup levels for sediment at IR Site 24. The preliminary RGs for sediment (derived in Section 3.4) are based on potential risk to ecological receptors. However, because the sediment could potentially be classified as hazardous waste if removed as part of sampling or dredging activities, substantive provisions of the following hazardous waste characterization requirements have been identified as potentially applicable ARARs:

- RCRA hazardous waste definition at *California Code of Regulations* (Cal. Code Regs.) tit. 22, § 66261.24(a)(1) for characterizing waste prior to disposal
- State definitions of waste at Cal. Code Regs. tit. 27, §§ 20210, 20220(a), and 20230(a) and the definitions of state regulated non-RCRA hazardous waste at Cal. Code Regs. tit. 22, § 66261.24(a)(2)–(a)(8) for characterizing sediment prior to off-site disposal

The Toxic Substances Control Act regulates the storage and disposal of PCBs. These requirements have both action- and chemical-specific aspects. The substantive provisions at 40 C.F.R. § 761.61(c)(2) have been identified as potentially relevant and appropriate chemical-specific ARARs for the remedial action alternatives that include sampling, cleanup, and disposal of sediment containing PCBs.

3.3.1.2 SURFACE WATER

Surface water has not been identified as a medium of concern for IR Site 24, and no remedial action has been identified as necessary for surface water at IR Site 24. However, remedial action for sediment at IR Site 24 may result in a discharge to surface water. Therefore, chemical-specific ARARs have been identified for surface water. Substantive provisions of the following requirements are potential chemical-specific ARARs for remedial action at IR Site 24:

- water quality standards at 40 C.F.R. § 131.36(b) and 131.38 for dewatering effluent discharge to surface water
- National Ambient Water Quality Criteria for cadmium, specifically 33 U.S.C. ch. 26, § 1314(a) and 42 U.S.C. ch. 103, § 9621(d)(2) 64 FR 19,781 (22 April 1999), 65FR31682
- Water Quality Control Plan for the San Francisco Bay Basin; Chapter 2, Beneficial Uses, designated for IR Site 24; and Chapter 3, Water Quality Objectives, for turbidity and suspended sediment with the exception of nuisance (to protect beneficial uses)
- State Water Resources Control Board (SWRCB) Resolution (Res.) No. 68-16 for new discharges associated with the dredging and dewatering effluent. The Navy's position is that SWRCB Res. No. 68-16 is not a chemical-specific ARAR for setting sediment cleanup levels. The state does not agree with the Navy's position on Res. 68-16. See Appendix A, Section A2.2.2.2, for detailed discussion about the Navy and state positions on Res. 68-16.
- Policy for Implementation of Toxic Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (SIP), Section 1.3 and 1.4, for dewatering effluent discharge to the bay. The SIP is not an ARAR for setting sediment cleanup levels or dredging discharges. See Appendix A, Section A2.2.2.2, for Navy and state positions and agreement on the SIP.

3.3.2 Potential Location-Specific ARARs

Location-specific ARARs may restrict remedial activities based on site locations or conditions. Specific locations include floodplains, wetlands, historic places, and sensitive ecosystems or habitats. There are no known or suspected cultural resources, wetlands or floodplains resources, or hydrological or geological resources at IR Site 24.

Biological resources and coastal resources are the resource categories relating to location-specific requirements potentially affected by the IR Site 24 remedial action alternatives. The conclusions for potential ARARs pertaining to biological and coastal resources are presented below. Detailed discussions of potential location-specific ARARs are presented in Appendix A, Section A3.2.

3.3.2.1 BIOLOGICAL RESOURCES

The substantive provisions of the Endangered Species Act of 1973 at 16 U.S.C. § 1536(a) and (h)(1)(B) are potential ARARs because the California least tern may use IR Site 24 as foraging area. Migratory birds are known to occur at Alameda Point; therefore, substantive provisions of the Migratory Bird Treaty Act at 16 U.S.C. § 703 were identified as potential ARARs.

Since IR Site 24 is located in the San Francisco Bay, the remedial action may potentially affect marine mammals. Therefore, the substantive provision of the Marine Mammals Protection Act at 16 U.S.C. § 1372(a)(2) was identified as a potential ARAR.

3.3.2.2 COASTAL RESOURCES

Remedial alternatives considered in this FS Report propose activities within the coastal zone. The Coastal Zone Management Act (CZMA) was evaluated and certain substantive provisions were determined to be relevant and appropriate federal requirements. CZMA § 1456(c)(1)(A) requires each federal agency activity within or outside the coastal zone that affects any land or water use or natural resource to conduct its activities in a manner that is consistent to the maximum extent practicable with enforceable and approved state management policies. The State of California's approved coastal management program includes the McAteer-Petris Act, the authorizing legislation for the San Francisco Bay Plan, developed by the Bay Conservation and Development Commission (BCDC). Substantive provisions of the McAteer-Petris Act at *California Government Code* (Cal. Gov't. Code) tit. 7.2, §§ 66600 through 66661 and the San Francisco Bay Plan at Cal. Code Regs. tit. 14, §§ 10110 through 11990 are potential state location-specific ARARs. Under Cal. Gov't. Code tit. 7.2, § 66610(b), the jurisdiction of the BCDC is a shoreline band located 100 feet inland from and parallel to the shoreline.

3.3.2.3 HYDROLOGIC RESOURCES

The substantive provisions of the Fish and Wildlife Coordination Act at 16 U.S.C. § 662 have been determined to be a potentially applicable ARAR for the alternatives that include dredging and filling that could potentially affect fish and wildlife. The remedial action will be designed to prevent loss of or damage to fish and wildlife.

3.4 SEDIMENT GOALS FOR PROTECTION OF ECOLOGICAL RECEPTORS

RAOs are site-specific, qualitative goals that define the purpose of site cleanup. RAOs for IR Site 24 were identified in Section 3.2. RAOs specify COCs, exposure routes and receptors, and acceptable contaminant concentration levels (or a range) for each exposure route.

An RG is a chemical concentration that provides a quantitative means of identifying areas for potential remedial action, screening the types of appropriate technologies, and assessing the potential of each remedial alternative to achieve the RAOs.

This section summarizes the development of the preliminary RGs for IR Site 24 based on the conclusions presented in the RI Report (Battelle et al. 2007). The RI Report identified the key risk drivers as cadmium, lead, total DDx, and total PCBs for ecological receptors. Because these are the same chemicals that are present in adjacent Seaplane Lagoon (IR Site 17), where RGs have been developed (DON 2006), and due to the uncertainties noted in the RI Report, the development of preliminary RGs for IR Site 24 is supplemented by data and analysis conducted for the adjacent Seaplane Lagoon.

During the development of the RG for cadmium in sediment at IR Site 17, protective sediment values for cadmium for the protection of fish at Seaplane Lagoon (Battelle 2005) were estimated to range from 19.6 mg/kg to 61.9 mg/kg (dry weight). These ecological protective sediment values were based on literature-based no-observed-effect and lowest-observed-effect values and a site-specific bioaccumulation factor (BAF) of 0.0274. However, the available cadmium no-observed-effect data set was considered insufficient for developing a final RG (Battelle et al. 2004, Battelle 2005). Therefore, the cadmium concentration in sediment considered protective of fish at Seaplane Lagoon was the RG for the protection of avian receptors (Battelle et al. 2004, Battelle 2005). Similarly, for IR Site 24, the cadmium no-observed-effect data are insufficient to develop an RG that would be protective of fish. Therefore, the avian RG is also considered protective of fish receptors at IR Site 24.

RGs protective of the least tern and other avian receptors for Seaplane Lagoon were calculated for cadmium, total DDx, and total PCBs. An RG was not developed for lead at Seaplane Lagoon because of uncertainties associated with the bioavailability and toxicity of lead to avian receptors.

The avian toxicity reference value for lead (0.014 mg/kg-day) recommended by DTSC (Cal/EPA 2000) and used in the RI Report (Battelle et al 2007) is significantly lower than the value (1.63 mg/kg-day) used by U.S. EPA in the interim final guidance for ecological soil screening levels (U.S. EPA 2005). In addition, lead was the only COC that resulted in a finding of potential risk for avian receptors due to exposure to reference concentrations. The spatial distribution of sediment lead concentrations in the AOEC at IR Site 24 is similar to that of cadmium (Figure 3-2); therefore, the preliminary RG for cadmium is expected to reduce potential ecological risk due to lead concentrations as well.

Due to the uncertainties described in the RI Report associated with the estimated risks, particularly with the site-specific estimates of bioaccumulation used to develop BAFs, calculation of site-specific RGs would have similar uncertainties. Therefore, the RGs adopted in the final ROD for IR Site 17 (Seaplane Lagoon) are used in this FS Report as preliminary RGs for IR Site 24 (Table 3-2) (DON 2006).

The RGs for Seaplane Lagoon were based on Navy-Biological Technical Assistance Group (BTAG) (EFA-West 1998, Cal/EPA 2000) no-observed-adverse-effect-level toxicity reference values (TRVs). The TRV was adjusted for receptor body weight according to Sample and Arenal (Sample and Arenal 1999). An average least tern body weight estimate (0.045 kilogram [kg]) was used, as reported in the RI Report. The least tern ingestion rate was estimated as 0.0083 kg/day using an equation from Nagy et al. (Nagy et al. 1999). An updated equation (Nagy et al. 2001) estimates the ingestion rate at 0.0097 kg/day, which is a small difference when compared to the range of sediment COC concentrations. For cadmium, an RG value of 20.8 mg/kg would be calculated using the updated ingestion equation; this value is similar to the proposed RG of 24.4 mg/kg and would achieve the same RAO because there are no cadmium concentrations at IR Site 24 between these two values.

The site use factor (SUF) was based on a review of least tern use of waters around Alameda Point over a 10-year period; Seaplane Lagoon and IR Site 24 are located in an area that received approximately 10 percent of the least tern foraging activity.

3.4.1 Cadmium Goal

For cadmium, the preliminary RG is based on the BAF developed from Seaplane Lagoon data for the clam, *Macoma nasuta*. Because cadmium did not accumulate in the tissues of fish to the same degree as in the tissues of clams, and because cadmium concentrations in least tern prey are likely to be lower than in the clam, protective sediment values based on clam BAFs are considered to be conservative. Protective sediment values for cadmium for the least tern ranged from 2.44 mg/kg dry weight at an SUF of 1 to 244 mg/kg dry weight at an SUF of 0.01. The preliminary RG in sediment for cadmium is 24.4 mg/kg dry weight based on the site-specific 10 percent SUF. This preliminary RG for cadmium is the same as the RG established for cadmium at IR Site 17 in the final ROD (DON 2006).

3.4.2 Total DDx Goal

For total DDx, the preliminary RG is based on the BAF developed from Seaplane Lagoon data for the clam, *M. nasuta*. Although the forage fish BAF was greater than the clam BAF, the incremental reduction of risk is expected to be greater based on the clam BAF. The protective sediment values for the least tern ranged from 0.013 mg/kg dry weight at an SUF of 1 to 1.34 mg/kg dry weight at an SUF of 0.01. Applying the site-specific SUF (10 percent), the preliminary RG in sediment for total DDx is 0.13 mg/kg dry weight. This preliminary RG for total DDx is the same as the RG established for total DDx at IR Site 17 in the final ROD (DON 2006).

None of the total DDx concentrations exceeded the preliminary RG. Although total DDx in sediment at IR Site 24 was identified as having a limited potential for adverse effects on the least tern (the most sensitive avian receptor), the HQ_{low} (1.06) only slightly exceeded 1 when a site-specific SUF was used. In addition, the spatial distribution of total DDx concentrations in sediment in the AOEC is similar to that for PCBs. (A review of Table 2-2 shows that the five sediment samples containing the highest total 4,4'-DDx values also contain the five highest total PCB values.) Therefore, the use of the preliminary RG for PCBs is expected to reduce the potential ecological risk due to total DDx concentrations as well.

Total 4,4'-DDx has been used as a surrogate for total DDx because 2,4'-DDx compounds were not measured at IR Site 24 prior to 1998, and the total DDx preliminary RG is based on total 4,4'-DDx. To evaluate the uncertainty associated with the 2,4'-DDx concentrations, the total DDx preliminary RG was also compared to the sum of total 4,4'-DDx and total 2,4'-DDx (which is the sum 2,4'-DDT, 2,4'-DDE, and 2,4'-DDD). The sum of total 4,4' DDx and total 2,4'-DDx exceeded the preliminary RG in C-21 subsurface sediment (5–25 cm) and C-23 surface sediment. Total DDx and total PCBs exceeded their respective preliminary RGs at these locations, so the uncertainty of the 2,4'-DDx concentrations is adequately addressed by the similarity of their distribution to the distributions of total DDx and total PCBs.

3.4.3 Total PCBs Goal

For total PCBs, the preliminary RG is based on the BAF developed from forage fish data from Seaplane Lagoon. This approach is based on the most sensitive receptor, the adult least tern, using the most conservative BAF, based on forage fish tissue. Forage fish accumulated PCBs at a greater rate than did the clam. Protective sediment values for the least tern ranged from 0.11 mg/kg dry weight at an SUF of 1 to 11.3 mg/kg dry weight at an SUF of 0.01. Applying the site-specific SUF (10 percent), the preliminary RG in sediment for total PCBs is 1.13 mg/kg dry weight. This preliminary RG for total PCBs is the same as the RG established for total PCBs at IR Site 17 in the final ROD (DON 2006). Consideration will be given to achieving an areawide average total PCB concentration that is consistent with the upper-bound nearshore ambient concentration for total PCBs (i.e., 0.2 mg/kg). The area-weighted average total PCB concentrations within IR Site 24 following remediation will be comparable to the upper bound estimate (i.e., 0.2 mg/kg) of the nearshore ambient concentration calculated for the San Francisco Bay area.

3.4.4 Lead Goal

As noted in Section 3.4, a preliminary RG for lead was not developed due to the associated uncertainties. Due to similar distributions of cadmium and lead, the cadmium preliminary RG is expected to reduce ecological risk associated with lead concentrations. To evaluate this expectation, the 2005/2006 surface sediment data set was revised eliminating four lead concentrations that were associated with sampling locations where cadmium exceeded the preliminary RG. After removing these four values, the new sediment lead data set (n = 27) would range from 12 to 140 mg/kg with a mean of 46.4 mg/kg and a 95 percent upper confidence limit (UCL) of 75.7 mg/kg (calculated using U.S. EPA's ProUCL program). An HQ was recalculated for the least tern (the most sensitive ecological receptor) using the same exposure factors used in the RI Report (except that the ingestion rate here is based on equations by Nagy [2001]) (Table 3-3). Using an SUF of 10 percent, the HQ based on the revised sediment EPC (HQ 14) is nearly equivalent to the HQ associated with the ambient concentrations (HQ 13). This evaluation shows that the use of the cadmium preliminary RG will successfully reduce ecological risk associated with sediment lead concentrations.

3.5 VOLUME OF IMPACTED SEDIMENT

This subsection provides a discussion of the volume estimate of contaminated sediment exceeding the preliminary RGs (Table 3-2) in the AOEC at IR Site 24. This volume estimate will be used in subsequent sections for evaluating remedial alternatives.

Figure 3-1 depicts the estimated AOEC based on locations of sediment samples with cadmium and total PCBs concentrations above the preliminary RGs. Based on the AOEC shown on Figure 3-1, impacted sediment appears to be limited to an area of approximately 18,000 square feet and an approximate depth of 20 inches (50 cm) below the sediment surface. For the purpose of estimating the volume of contaminated media exceeding the preliminary RGs, it was assumed that 50 percent of the AOEC contained sediments with COC exceedances extending no deeper than 1 foot (30 cm) below the sediment surface, and that the other 50 percent of the AOEC contained sediments with COC exceedances extending no deeper than 2 feet (60 cm) below the sediment surface. At two sampling locations, subsurface data exceeded the preliminary RGs; however, such COC concentrations are not expected to continue much farther with sediment depth in the shelf area. Based on the estimated AOEC areas and depths, the volume of impacted sediment is approximately 27,000 cubic feet or 1,000 bank cubic yards (bcy).

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Section 4
IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES

This section discusses general response actions and associated technologies capable of addressing the COCs in sediment at the AOEC at IR Site 24 (Figure 3-1). The remedial technologies are screened for effectiveness, implementability, and cost (U.S. EPA 1988). Technologies retained after the screening evaluation are then assembled into remedial alternatives in Section 5.

Technologies are assessed primarily on the basis of their ability to address the COCs identified in Section 3.1. However, the impact of the technologies on other constituents in sediment is also discussed.

4.1 GENERAL RESPONSE ACTIONS

General response actions are broad categories of remedial approaches. Some response actions may stand alone as complete remedial alternatives. However, in most cases, combinations of response actions are required to effectively address site-related contamination and satisfy RAOs.

The following general response actions are considered for sediment in this FS Report.

- **No action** entails no further response actions of any type, including administrative controls or monitoring. The NCP and CERCLA require consideration of a no action alternative as a basis for comparison with other remedial alternatives.
- **Institutional controls (ICs)** reduce potential hazards by limiting exposure to impacted sediment through legal and administrative measures. ICs do not reduce the volume, mobility, or toxicity of contaminants in sediment. Examples of such controls include restrictions or prohibitions on fishing and harvesting shellfish, restrictions on waterway use, restrictions on dredging or excavation, or structure maintenance requirements placed on property deeds or titles.
- **Monitoring** may include technical measures such as bathymetric surveying or sediment sampling and analysis to evaluate the extent and migration of impacted sediment and/or changes in site conditions over time.
- **Monitored natural recovery (MNR)** relies on naturally occurring processes to contain, destroy, or reduce the bioavailability or toxicity of contaminants in sediment. These processes may include physical, biological, or chemical mechanisms that act to reduce the risk to human and ecological receptors from contaminants.
- **Containment** technologies control risk by eliminating routes of exposure or reducing exposures to acceptable levels through physical control of impacted sediment. Containment may reduce contaminant mobility but does not provide treatment and would not necessarily reduce the toxicity or volume of contaminants. These technologies usually require continued monitoring and ICs to confirm that the containment measures are performing successfully. An example of a containment technology is *in situ* capping, which refers to the

placement of a subaqueous covering or cap of clean granular material over impacted sediment that remains in place.

- **Removal** involves the dredging or excavation of impacted sediment. Sediment is removed and either stockpiled on-site for treatment or transported to a permitted off-site treatment, storage, and disposal (TSD) facility. The transportation, treatment, and disposal of water from dewatered sediments are generally included in this remediation method. If off-site disposal is considered, some pretreatment may be required to meet land disposal restrictions. Off-site management of impacted media must meet stringent state and federal regulations governing the transportation and disposal of solid, liquid, and hazardous wastes.
- **Disposal** of impacted sediment that is removed by dredging or excavation involves dewatering, transport, and placement of sediment at a secure, approved location.
- ***In situ* treatment** involves using biological, physical, or chemical processes to treat impacted sediment in place. These processes may be used to break down contaminants and/or alter their properties so they can be easily extracted, destroyed, stabilized, or immobilized.

4.2 IDENTIFICATION OF REMEDIAL TECHNOLOGIES

Since the inception of CERCLA in 1980, the U.S. EPA has found that certain categories of sites share similar characteristics, including types of contaminants present, past disposal practices, affected environmental media, and preferred remedial technologies. Several initiatives have been undertaken to incorporate this information and streamline the CERCLA FS process based on historical patterns of CERCLA remedy selection and site performance data. However, sediment sites are unique, and no standard approaches are recommended for contaminated sediments. The overall risk reduction strategy for contaminated sediment sites depends on a large number of site-specific considerations, some of which may be subject to significant uncertainty (U.S. EPA 2005).

An important part of the CERCLA streamlining effort involves reducing the level of documentation required in an FS report. Earlier guidance (U.S. EPA 1988) suggested that a two-step screening process was necessary to identify and select remedial technologies and process options before the development of remedial alternatives for detailed analysis. The initial screening step involved technology identification and preliminary screening based only on technical implementability. Results of this screening, combined with literature searches, U.S. EPA guidance document reviews, and engineering judgment, were used to identify viable technologies for treatment of impacted sediment, which are discussed in the following subsection.

4.3 SCREENING OF REMEDIAL TECHNOLOGIES

For each remedial technology, associated process options have been identified. Table 4-1 lists the general response actions, remedial technologies, and process options identified for consideration to address impacted sediment at IR Site 24. Remedial technologies and associated process options were screened for effectiveness, implementability, and cost. The objective of this screening was to select appropriate process options for each technology and to use the selected technologies to formulate remedial alternatives. Development and evaluation of these remedial alternatives are discussed in Section 5.

The screening criteria were applied based on their relative importance to the FS process (U.S. EPA 1988). The criterion of effectiveness was given the most weight, followed by implementability, and then by cost. When two or more process options yielded comparable results, cost was the deciding factor. Factors considered for the screening criteria are provided in Table 4-2.

The following subsections discuss the screening results. Results for process options are grouped by general response action (Section 4.1) and technology. Table 4-3 summarizes the screening results and lists process options retained for the development of remedial alternatives (Section 5).

4.3.1 No Action

The no action process option was included in the screening process in accordance with CERCLA and NCP requirements, to serve as the baseline for comparison with other response actions. No action, for the purposes of this FS Report, would represent existing conditions at IR Site 24.

4.3.1.1 EFFECTIVENESS

The no action process option would not include any monitoring, sampling, or remediation activities, and would not restrict future uses of IR Site 24. This process option would not include monitoring to verify its protectiveness. Therefore, this process option would not be effective in reducing potential risks to ecological receptors and achieving the RAOs.

4.3.1.2 IMPLEMENTABILITY

The no action process option is rated high in implementability because no action is required.

4.3.1.3 COST

There are no direct costs associated with the no action process option.

4.3.1.4 CONCLUSION

The no action process option for sediment at IR Site 24 is retained for consideration in accordance with requirements of CERCLA and the NCP, and serves as the baseline for comparison with other response actions.

4.3.2 Institutional Controls

ICs are legal and administrative mechanisms used to implement land use and access restrictions to limit the exposure of ecological receptors to hazardous substances. ICs also may be used to achieve continued protectiveness (e.g., to protect a sediment cap) or to maintain the integrity of the remedial action until remediation is complete and RGs have been achieved. ICs would not treat impacted sediment, but would prohibit unacceptable exposure to the contaminants by ecological receptors.

The IC objectives would generally be to:

- prohibit disturbance to and resuspension of impacted sediment by restricting future dredging and construction activities in the AOEC without approval from the Navy and regulatory agencies;
- prohibit removal of the wharf road without approval from the Navy and regulatory agencies; and
- prohibit the alteration, disturbance, or removal of monitoring systems and remediation elements during remedial action.

ICs would remain in place until the Navy and regulatory agencies agree that further protective measures are no longer required.

The Navy would rely on proprietary controls in the form of lease restrictions contained in the "Lease in Furtherance of Conveyance (LIFOC) between the United States of America and the Alameda Reuse and Redevelopment Authority for the Former Naval Air Station Alameda" (DON and ARRA 2001). Restrictive covenants would be included in a "Covenant to Restrict Use of Property" entered into by the Navy and DTSC and in quitclaim deed(s) as provided in the Navy/DTSC MOA (Attachment A) and consistent with the substantive provisions of Cal. Code Regs. tit. 22, § 67391.1.

Through the LIFOC, the Navy would maintain conditions at IR Site 24 that are consistent with the IC objectives and associated land-use restrictions for the remedial alternative chosen. The LIFOC contains provisions that the Navy can use to prevent:

- changes in land use by requiring the lessee and sublessee to obtain written consent from the Navy before dredging, excavation, construction, alteration, or repairs of leased property can begin (Section 8.1 of the LIFOC);
- the lessee from conducting operations that interfere with environmental restoration by the Navy, the U.S. EPA, state regulators, or their contractors, by requiring written approval for any work by lessee or sublessee in proximity to the site (Section 11 of the LIFOC); and
- the lessee or sublessee from any dredging, excavation, digging, drilling, or other disturbance of the subsurface and sediment without written approval of the Navy (Section 13.11 of the LIFOC).

4.3.2.1 CONVEYANCE TO A NONFEDERAL ENTITY

When an Alameda Point property is transferred to a nonfederal entity, the IC objectives to be achieved through land-use restrictions for IR Site 24 would be incorporated into the following two separate legal mechanisms.

- If the property was transferred, restrictive covenants would be included in one or more quitclaim deeds from the Navy to the property recipient.

- Restrictive covenants would be included in a Covenant to Restrict Use of Property entered into by the Navy and DTSC, as provided in the Navy/DTSC MOA (Attachment A) and consistent with the substantive provisions of Cal. Code Regs. tit. 22, § 67391.1.

The Covenant to Restrict Use of Property would incorporate the land-use restrictions into environmental restrictive covenants that run with the land and that are enforceable by DTSC and the Navy against future transferees. The quitclaim deed(s) would include the identical land-use restrictions in environmental restrictive covenants that run with the land and that would be enforceable by the Navy against future transferees.

According to the Navy Principles and Procedures for Specifying, Monitoring, and Enforcement of Land Use Controls and Other Post-ROD Actions (Attachment B), the following issues related to ICs would be addressed in the ROD and remedial design for IR Site 24:

- description of the risk(s) necessitating the ICs
- documentation of risk exposure assumptions and reasonably anticipated land uses
- general description of the ICs, the logic for their selection, and related deed restrictions/notifications
- statement of the IC performance objectives
- list of the parties responsible for monitoring, reporting, and enforcing the ICs
- description of the area/property covered by the ICs
- expected duration of the ICs
- reference to an IC remedial design for implementation actions, because these details may have to be adjusted periodically on the basis of site conditions and other factors

4.3.2.2 CONVEYANCE TO A FEDERAL DEPARTMENT OR AGENCY

If property at IR Site 24 was transferred by the Navy to a federal department or agency, the IC objectives/land-use restrictions set forth in Section 4.3.2.1 would be incorporated into an MOA or similar agreement.

4.3.2.3 IMPLEMENTATION AND OVERSIGHT

Monitoring and inspections would be conducted to assure that the ICs were being followed (see Attachment B). The Navy and FFA signatories and their authorized agents, employees, contractors and subcontractors would have the right to enter upon IR Site 24 to conduct investigations, tests, or surveys; inspect field activities; or construct, operate, and maintain any response or remedial action as required or necessary under the remediation program. These access requirements would be included in the deed and covenant for property conveyed to a nonfederal entity and in the MOA if property was conveyed to a federal entity.

The Navy would address IC implementation and maintenance actions, including periodic inspections, in the preliminary and final remedial design reports to be developed and submitted to the FFA signatories for review and approval pursuant to the FFA (see Attachment B). The preliminary and final remedial design reports are primary documents, as provided in Section 10.3 of the FFA.

The preliminary and final remedial design reports would include a section to describe required IC implementation actions including:

- requirements for CERCLA 5-year remedy review;
- frequency and requirements for periodic monitoring or visual inspections and reporting results from monitoring and inspections;
- notification procedures to the regulators for planned property conveyance, changes, and/or corrective action required for the remedy;
- development of wording for land-use restrictions and parties to be provided copies of the deed language once executed;
- identification of responsibilities for Navy, U.S. EPA, DTSC, Water Board, other government agencies, and the new property owner for implementation, monitoring, reporting, and enforcing ICs;
- a list of ICs with their expected duration; and
- maps identifying where ICs are to be implemented.

The Navy would be responsible for implementing, inspecting, reporting, maintaining, and enforcing the necessary IC objectives described in the ROD, and land-use restrictions and implementation actions described in the approved remedial design reports. Although the Navy might later transfer these procedural responsibilities to another party by contract, property transfer agreement, or other means, the Navy would retain ultimate responsibility for remedy integrity. Should any of the ICs fail, the Navy would ensure that appropriate actions would be taken to reestablish protectiveness of the remedy and might initiate legal action to either compel action by a third party(parties) and/or recover the Navy's costs for mitigating any discovered IC violation(s).

4.3.2.4 EFFECTIVENESS

ICs for IR Site 24 would be effective in minimizing disturbance of sediment, but would not actively treat contaminants. ICs might also be effective as an interim strategy with other remedial process options implemented at the site by preventing disturbance of impacted sediment until RAOs are achieved, or to maintain protectiveness of a selected remedy.

4.3.2.5 IMPLEMENTABILITY

ICs are readily implementable at IR Site 24. There is a precedent for the use of ICs at Alameda Point.

4.3.2.6 COST

ICs are expected to be moderate in cost compared to other process options. Total cost would depend on the duration of ICs.

4.3.2.7 CONCLUSION

ICs are effective, implementable, and low in cost. Therefore, they are retained for further consideration.

4.3.3 Monitoring

Monitoring would involve bathymetric surveying, sediment sampling and analysis, and reporting. Sediment would be sampled periodically and analyzed to assess changes in site conditions over time.

4.3.3.1 EFFECTIVENESS

Monitoring as a stand-alone action is not effective at reducing the mass, volume, or toxicity of contaminants in sediment. It is effective as a means of verifying site conditions, tracking COC concentrations in sediment in the biologically active zone, and assessing remediation progress.

4.3.3.2 IMPLEMENTABILITY

Monitoring is implementable at IR Site 24, as demonstrated by previous investigations at the site. Sampling and analytical methods are available to monitor changes in contaminant concentrations in sediment.

4.3.3.3 COST

Capital costs associated with monitoring are low. Operation and maintenance (O&M) costs can be moderate to high depending on the number of sampling locations in the monitoring program, sampling frequency, and duration of the monitoring program. To manage costs, this process option must be planned and executed effectively and the monitoring program must be of a limited duration.

4.3.3.4 CONCLUSION

When combined with other process options, monitoring is a practical method of tracking the effectiveness of remediation technologies at IR Site 24. Therefore, this process option is retained as a component of remedial alternatives.

4.3.4 Monitored Natural Recovery

MNR uses ongoing, naturally occurring processes to contain, destroy, or reduce the bioavailability or toxicity of contaminants in sediment. MNR is similar in some ways to the monitored natural attenuation (MNA) remedy used for groundwater and soils. The key difference between MNA for groundwater and MNR for sediment is in the type of processes most often being relied upon to reduce risk. Transformation of contaminants is usually the principal attenuating process for contaminated groundwater; however, these processes are frequently too slow to accomplish the remediation of persistent contaminants in sediment in a reasonable time frame. Instead, isolation and mixing of contaminants through natural sedimentation is the process most frequently relied upon for contaminated sediment (U.S. EPA 2005). Use of this natural "capping" process at IR Site 24 would form a protective barrier that would minimize diffusion of contaminants to the water column, resuspension of impacted sediment, and exposure of ecological receptors to contaminants in sediment. The actual sedimentation rate at IR Site 24 is currently unknown; the sedimentation rate at nearby IR Site 17 (Seaplane Lagoon) has been estimated at approximately 0.6 to 0.7 inches (1.5 to 1.7 cm) per year (Battelle 2005). MNR is considered appropriate for the AOEC at IR Site 24 because this area is protected from high-energy forces such as boat wakes, propeller scour, keel drag, or large-boat anchoring that would minimize the effectiveness of the natural sedimentation process.

The success of MNR as a risk reduction approach is typically dependent upon understanding the dynamics of the impacted environment and the fate and mobility of the contaminants in that environment. The natural processes of interest for MNR may include a variety of processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, or concentration of contaminants in the sediment bed. These natural processes may include the following (U.S. EPA 2005):

- physical processes – sedimentation, advection, diffusion, dilution, dispersion, bioturbation, and volatilization
- biological processes – biodegradation, biotransformation, phytoremediation, and biological stabilization
- chemical processes – oxidation/reduction, sorption, or other processes resulting in stabilization or reduced bioavailability

Natural processes that reduce toxicity through transformation or reduce bioavailability through increased sorption are usually preferable as a basis for remedy selection to mechanisms that reduce exposure through natural burial or mixing-in-place because the destructive/sorptive mechanisms generally have a higher degree of permanence. However, many contaminants that remain in sediment are not easily transformed or destroyed. For this reason, risk reduction due to natural burial through sedimentation is more common and can be an acceptable sediment management option. Dispersion is the least preferable basis for remedy selection based on MNR. While dispersion may reduce risk in the source area, it generally increases exposure to contaminants and may result in unacceptable risks to other areas (U.S. EPA 2005).

4.3.4.1 EFFECTIVENESS

MNR should be effective in reducing concentrations of COCs in sediment over the long term under suitable conditions (e.g., sufficient sedimentation and biotic/abiotic contaminant degradation) at IR Site 24.

4.3.4.2 IMPLEMENTABILITY

MNR is readily implementable at IR Site 24. No construction or infrastructure (for materials handling, treatment, or disposal facilities) is needed for the implementation of MNR, and may, therefore, be much less disruptive than active remedies. Sampling and analytical methods are available to monitor sediment deposition rates and changes in contaminant concentrations in sediment.

4.3.4.3 COST

MNR has a low capital cost and moderate to high O&M costs as long as the monitoring shows that risk reduction is taking place at a reasonable rate. Total cost would depend on the duration required to reach RAOs. Therefore, the cost of MNR is highly variable, and would depend on the effectiveness of the MNR process and the actual duration required.

4.3.4.4 CONCLUSION

MNR is retained as a process option for IR Site 24. MNR may be effective in reducing contaminant concentrations; however, an extended period of time could be required to achieve RAOs.

4.3.5 Containment

In situ capping was selected as the representative process option for containment technologies in this FS Report. Capping refers to the placement of a subaqueous covering or cap of clean material over impacted sediment that remains in place, to isolate contaminants from the surrounding environment and potential receptors. Depending on the contaminants and sediment environment, a cap is designed to reduce risk through one or more of the following primary functions (U.S. EPA 2005):

- physical isolation of the impacted sediment, to reduce exposure due to direct contact and to reduce the ability of burrowing organisms to move contaminants to the surface
- stabilization and erosion protection of impacted sediment and cap, to reduce resuspension and transport to other areas
- chemical isolation of impacted sediment, to reduce exposure from dissolved and colloidally bound contaminants transported into the water column

Caps are generally constructed of granular material, such as sand or gravel. Thin-layer capping is considered appropriate for the AOEC at IR Site 24 because this remedial action would isolate impacted sediment from benthic invertebrates. Thin-layer caps are generally a few inches to 1 foot in thickness, utilize clean material, and are intended to isolate contamination and enhance ongoing natural recovery processes (Battelle 2005). A more complex cap design can include geotextiles, liners, and other permeable or impermeable elements in multiple layers that may include additions of material to attenuate the flux of contaminants (e.g., organic carbon) (U.S. EPA 2005). *In situ* capping is generally most appropriate for locations where the risk associated with contaminants is low to moderate, routine disturbance (e.g., maintenance dredging) is not required to support functions such as navigation, and in low-turbulence environments that ensure cap stability. Capping can also be used at higher-risk sites where more intrusive remediation techniques (i.e., dredging and removal of impacted sediment) are not viable or are cost-prohibitive (Battelle 2005).

Granular cap material can be handled and placed in a number of ways. Mechanically excavated materials such as sand or gravel from an upland site or quarry usually have relatively little free water. Normally, these materials can be handled mechanically in a dry state until released into the water over the impacted site. Mechanical methods (e.g., clamshells or release from a barge) rely on gravitational settling of cap materials in the water column, and could be limited to particular depths in their application. Granular cap materials can also be entrained in a water slurry and carried wet to the impacted site, where they can be discharged by pipe into the water column at the water surface or at depth. This hydraulic method offers the potential for a more precise placement, although the energy required for slurry transport could require dissipation to prevent resuspension of impacted sediment. Placement of some cap components, such as geotextiles, may require special equipment.

High-energy forces such as significant currents, wave action, boat wakes, and propeller scour could destabilize and erode an *in situ* cap, so periodic maintenance may be necessary. Armoring is usually used in turbulent environments to reduce cap material resuspension, resist cap erosion, and maintain cap stability. Armor layer materials (e.g., gravel, cobbles, or stones) can be placed from barges or from the shoreline using conventional equipment such as clamshells. For IR Site 24, cap armoring would not be necessary for protection against erosional forces due to the absence of strong currents, boat wakes, propeller scour, and large-boat anchoring.

In situ capping can be implemented as a sole remedy or combined with other remedial technologies. For example, capping is sometimes considered following partial sediment removal in cases where capping alone is not feasible due to a need to preserve a minimum water body depth for navigation or flood control, or where it is desirable to leave deeper impacted sediment in place to preserve bank or shoreline stability following removal. Capping is generally combined with ICs to prevent disturbance of the cap, such as deed notices, physical access restrictions, structure maintenance requirements, navigational restrictions, and future dredging restrictions. A monitoring program is generally implemented to evaluate long-term integrity of the cap, recolonization by biota, and evidence of recontamination.

4.3.5.1 EFFECTIVENESS

Thin-layer capping should be effective in isolating impacted sediment at IR Site 24 and limiting exposure to benthic receptors. Capping is an effective remedial technology to address both organic and inorganic contamination at the site. Incidences of cap-disrupting human behavior, such as maintenance dredging and large-boat anchoring, are low or controllable at this site.

4.3.5.2 IMPLEMENTABILITY

Thin-layer capping is implementable at IR Site 24. It usually requires less infrastructure (e.g., materials-handling, treatment, or disposal facilities) and is less disruptive than dredging. Suitable types and quantities of cap material are readily available in the San Francisco Bay Area. Furthermore, contractors with experience in cap placement techniques can be found in the area.

4.3.5.3 COST

The capital costs for a thin-layer cap at IR Site 24 are expected to be moderate. Monitoring costs could be high, depending on the frequency and duration of monitoring.

4.3.5.4 CONCLUSION

Thin-layer capping would be effective and implementable at IR Site 24. Therefore, it is retained for further consideration.

4.3.6 Removal

Dredging and excavation are the two most common means of removing impacted sediment from a water body. The removal can be conducted while the sediment is submerged (dredging) or after water has been diverted or drained (excavation). Both methods typically necessitate transporting the sediment to a location for treatment and/or disposal. They also typically include treatment of water from dewatered sediment prior to discharge to the receiving water body or to a publicly owned treatment works, or disposal at a permitted off-site treatment and disposal facility. A silt curtain or silt screen could be used to minimize the transport of impacted sediment outside of the area during dredging operations (Battelle 2005, U.S. EPA 2005). Key components to be evaluated when considering dredging or excavation as a remedial technology include sediment removal, transport, staging, treatment of sediment and water (if necessary), and disposal of solid, liquid, and hazardous wastes (U.S. EPA 2005).

For this FS Report, dredging technologies are discussed and evaluated. Excavation technologies using conventional dry-land equipment (e.g., backhoes and excavators) are similar, except that the impacted area would have to be initially isolated from the overlying water body by pumping or diverting water from the area and managing any continuing water inflow during excavation activities.

4.3.6.1 DREDGING METHODS

Dredging involves mechanically grabbing, raking, cutting, or hydraulically scouring the bottom of a water body to dislodge the sediment. Once dislodged, the sediment may be removed either mechanically with buckets or hydraulically by pumping. Therefore, dredges may be categorized as either mechanical or hydraulic, depending on the means of removing the dredged material. Some dredges employ pneumatic (compressed air) systems to pump the sediment out of the water body; however, these systems have not gained general acceptance on environmental dredging projects (U.S. EPA 2005).

Mechanical Dredging

The mechanical dredges most commonly used in the U.S. for environmental dredging are the following (Palermo et al. 2004):

- clamshell – wire-supported, conventional open clam bucket, circular-shaped cutting action
- enclosed bucket – wire-supported, near watertight or sealed bucket as compared to conventional open clam bucket (recent designs also incorporate a level cut capability as compared to a circular-shaped cut for conventional buckets)
- articulated mechanical device – backhoe designs, clam-type enclosed buckets, hydraulic closing mechanisms; all supported by an articulated fixed-arm device

The dredging bucket is dropped through the water column and penetrates into the sediment by gravity. The bucket is closed and lifted through the water column. When the bucket is above the water surface, it is moved to deposit the dredged material into a transport container or onto a suitable staging area. The container is generally a barge, hopper, or land-based truck. The staging area is commonly a dedicated shoreline area (e.g., an area for dewatering sediment) (Battelle 2005).

Mechanical dredges offer the advantage of removing the sediment at nearly the same density and, therefore, volume, as the *in situ* material. Little additional water is entrained with the sediment while it is being removed. However, some amount of water above the sediment would be collected by the bucket when it is closed and lifted through the water column. The water that is present in the bucket must either be collected, managed, and treated, or be allowed to leak out, which generally leads to higher contaminant losses during dredging. Enclosed buckets have been designed to remove sediment in thin layers and to create a tighter seal to reduce sediment loss, which minimizes sediment resuspension during the dredging operations (Battelle 2005, U.S. EPA 2005).

Other types of mechanical dredging systems include backhoes and dragline dredges. Backhoes (and larger excavators) are most effective in shoreline or shallow-water work where they can be placed on the shoreline or on barges to remove impacted sediment. Backhoes can be more effective than clamshells for removing dense or hard material and dredging slopes on shorelines. However, backhoes have not had extensive uses for impacted sediment removal projects because of the difficulty of excavating continuous, level areas and the potential loss and resuspension of sediment due to the open backhoe bucket.

Dragline dredges use a barge-mounted crane that is similar to a clamshell dredge system. The difference is that dragline buckets are open on one side and lowered into the sediment with a lifting cable, then pulled back or dragged towards the crane with a second cable. Draglines have been used extensively in navigational dredging because they are effective in removing large volumes of sediment. Draglines are rarely used for environmental dredging projects because the open side of the bucket does not effectively contain the dredged sediment, which increases the loss and resuspension rates of sediment.

Hydraulic Dredging

Hydraulic dredges remove and transport sediment in the form of a slurry through the inclusion or addition of high volumes of water in the removal process (Zappi and Hayes 1991). The total volume of material processed may be greatly increased and the solids content of the slurry may be considerably less than that of the *in situ* sediment, although solids content varies between dredges (U.S. EPA 1994). A large amount of water is usually added to create the slurry and transport the sediment through the pumps and pipelines. The volume of water is typically 5 to 10 times the in-place volume of sediment removed (Battelle 2005). The excess water is usually discharged as effluent at the treatment or disposal site and often needs treatment prior to discharge. Hydraulic dredges may be equipped with rotating blades, augers, or high-pressure water jets to loosen the sediment (U.S. EPA 1995).

The hydraulic dredges most commonly used in the U.S. for environmental dredging are the following (Palermo et al. 2004):

- cutterhead – conventional hydraulic pipeline dredge and cutterhead
- horizontal auger – hydraulic pipeline dredge with horizontal auger dredgehead (a device that sets into the sediment and contains a suction pipe inlet)
- plain suction – hydraulic pipeline dredge using dredgehead design with no cutting action
- pneumatic – air-operated submersible pump, pipeline transport, either wire supported or fixed-arm supported
- specialty dredgeheads – other hydraulic pipeline dredges with specialty dredgeheads or pumping systems
- diver-assisted – hand-held hydraulic suction with pipeline transport

The cutterhead system is the most common dredging technology used to remove sediment. Cutterhead dredges can remove a wide variety of sediment types, including dense sand and hard clay. Since suction dredges do not use a cutting device to loosen the sediment, these dredges can generally remove only soft sediment with little debris. Suction dredges often include water jets to help loosen the sediment.

4.3.6.2 EFFECTIVENESS

Dredging is an effective technology for removing contaminant mass from an impacted aquatic environment. It is effective at addressing any class of contaminant (i.e., organic or inorganic), as it physically and nonselectively removes impacted sediment. However, dredging effectiveness can be limited for achieving very low-concentration thresholds due to the potential for surface sediment mixing, resuspension, and redeposition (Battelle 2005). Sediment sampling before and after dredging operations may be required to determine the effectiveness of dredging and the attainment of RAOs.

The effectiveness of dredging can also be limited by the precision of the equipment. For mechanical dredging, the vertical and horizontal accuracies are generally less than 1 and

2 feet, respectively. Mechanical dredging usually leaves a rougher bottom surface than hydraulic dredging. Release of impacted sediment into the water column can be minimized by using an enclosed bucket that provides a better seal than a conventional open clam bucket. The transport of resuspended impacted sediment released during mechanical dredging can often be reduced by using physical containment barriers such as silt curtains or silt screens. Mechanical dredges remove the least amount of water, thus minimizing dewatering and/or treatment (Battelle 2005, U.S. EPA 2005).

The vertical and horizontal accuracies of hydraulic dredges are similar to mechanical dredges. Hydraulic dredging can leave a smoother bottom surface than mechanical dredging. Hydraulic dredging usually creates a sediment slurry with a higher water content, which can require additional dewatering and treatment. However, closed recirculation systems can be used to reduce the volume of water and slurry water content. As with mechanical dredging, a silt curtain or silt screen can be used to minimize the transport of impacted sediment outside of the treatment area during hydraulic dredging operations (Battelle 2005, U.S. EPA 2005).

Several site-specific factors at IR Site 24 are likely to affect the effectiveness of sediment removal/dredging and may increase the quantity of residuals when compared to open water dredging:

- the high number of obstructions limiting complete removal of sediment adjacent to the obstructions (wharf pilings, bulkhead, and rip-rap protection under the wharf)
- the difficulty of dredging on a slope; dredging equipment is designed for level surfaces and uses step-cuts to dredge on slopes, which leads to more residual material left in the steps than in level sites and an increased volume of over-dredging
- the difficulty of accurate control of the dredging equipment under the dock (e.g., GPS signal reception is not possible), which increases the possibility of incomplete removal of contaminated sediment

4.3.6.3 IMPLEMENTABILITY

Dredging is considered moderately implementable at IR Site 24 because of the limited access under the wharf road. Dredging underneath structures (e.g., pier, wharf, or road) typically is performed with smaller equipment and may pose technical challenges; therefore, it is less implementable than dredging in open-water areas. In addition, the presence of coarse debris mixed with the sediment will pose some difficulties with the dredging activities, and should be removed to the extent feasible before dredging.

4.3.6.4 COST

Total cost of dredging depends on the sediment volume to be removed. At IR Site 24, the AOEC is not extensive; therefore, the cost for this process is considered to be low to moderate. Debris in the AOEC may impede the dredging process.

4.3.6.5 CONCLUSION

Mechanical dredging and hydraulic dredging are proven sediment removal technologies. Dredging would be effective and implementable at IR Site 24. Therefore, sediment removal technologies such as mechanical and hydraulic dredging are retained for further evaluation.

4.3.7 Disposal

Disposal of impacted sediment is not a stand-alone remedial alternative for this FS Report, but would be used in association with sediment removal. The goal of sediment disposal is to manage dredged sediment to prevent contaminants from impacting human health and the environment.

4.3.7.1 DISPOSAL OPTIONS

Historically, impacted sediment from CERCLA sites has typically been managed in an upland sanitary or hazardous-waste landfill, and less frequently, in a confined disposal facility (CDF) or contained aquatic disposal (CAD). These disposal options are described below (U.S. EPA 2005).

Sanitary/Hazardous Waste Landfill

Existing commercial, municipal, or hazardous waste landfills are the most widely used option for disposal of dredged sediment and residual wastes. Landfills are also sometimes constructed on-site for a specific dredging or excavation project. Landfills can be categorized by the types of wastes they accept and the laws regulating their operations. Due to restrictions on liquids in landfills, sediment must usually be dewatered and/or stabilized/solidified before final disposal in a landfill (U.S. EPA 2005).

Confined Disposal Facility

A CDF is an engineered structure enclosed by dikes and is specifically designed to contain sediment. A CDF may be located upland (above the water table), near the shore (partially in the water), or completely in the water (island CDFs). CDFs have been widely used for navigational dredging projects and some combined navigational/environmental dredging projects but are less common for environmental dredging sites, due in part to siting considerations. Under normal CDF operations, water is discharged over a wire structure or allowed to migrate through the dike walls, while solids are retained within the CDF. Effluent guidelines or discharge permits typically govern the monitoring requirements of the water (U.S. EPA 2005).

Contained Aquatic Disposal

A CAD is a type of subaqueous capping in which the dredged sediment is placed into a natural or excavated depression elsewhere in the water body for later capping. A related form of disposal, known as level-bottom capping, places the dredged sediment on a level bottom elsewhere in the water body, where it is later capped. CAD has been used for navigational dredging projects, but has rarely been considered for environmental dredging projects. The depression used for CAD should provide lateral containment of the impacted material. The depression for the CAD cell may be excavated using conventional dredging equipment or a natural or historically dredged depression may be used. Uncontaminated material excavated from the depression may be subsequently used for the cap (U.S. EPA 2005).

4.3.7.2 EFFECTIVENESS

Disposal of impacted sediment to a landfill off-site or on-site is an effective method of preventing future contact or exposure to impacted sediment. CDFs and CADs can be effective for isolating impacted sediment and reducing ecological and environmental risks as long as the integrity of the structure or cap is maintained. However, for an on-site landfill (at Alameda Point), long-term monitoring, maintenance, and ICs would be required to maintain the integrity and effectiveness of the on-site landfill after closure.

4.3.7.3 IMPLEMENTABILITY

Disposal to an off-site landfill would be easily implemented for small quantities of dredged sediment like the quantities anticipated at IR Site 24. For larger quantities, implementability would be moderate to low. The wastes must be profiled and disposed according to the TSD facility requirements. TSD facilities in the state of California are capable of accepting dredged sediment and residual wastes in the quantity expected at IR Site 24.

An on-site landfill, CDF, or CAD could be constructed using conventional equipment and materials. However, the implementability of disposal to an on-site landfill, CDF, or CAD would be dependent on the availability of an appropriate location at Alameda Point and on obtaining the required permits to construct and operate a disposal site. Since the permitting process is expected to be prohibitively difficult, the implementability of disposing dredged sediment and residual wastes on-site in a landfill, CDF, or CAD is considered low.

4.3.7.4 COST

Disposal costs for dredged sediment and residual wastes could range from low to high, depending on the volume. The higher costs of transportation and disposal at a RCRA-permitted facility must be considered. RCRA hazardous waste would need to meet land disposal restrictions prior to disposal. This treatment would be performed by the receiving facility as required.

If a suitable site is available, the costs associated with approvals, permitting, and construction of an on-site landfill, CDF, or CAD are expected to be high. An on-site landfill, CDF, or CAD would require long-term monitoring, maintenance, and ICs; the costs associated with these actions can be moderate to high, depending on the duration.

4.3.7.5 CONCLUSION

Disposal of impacted sediment and residual wastes to an off-site landfill is retained for further evaluation in combination with the dredging technology. Disposal to an on-site landfill, CDF, or CAD is eliminated from further evaluation based on low implementability and high cost. These high costs are not considered justified for the anticipated volume of sediment at IR Site 24.

4.3.8 *In Situ* Treatment

In situ treatment is an approach that involves the biological, physical, or chemical treatment of impacted sediment in place. Most techniques for *in situ* treatment of sediment are emerging technologies that are in the early stages of development.

4.3.8.1 *IN SITU* TREATMENT OPTIONS

In situ treatment options potentially applicable to the impacted sediment at IR Site 24 are described below.

In Situ *Bioremediation*

In situ bioremediation (ISB) of impacted sediment is an emerging technology that generally includes the addition of nutrients and/or microorganisms to the impacted sediment to initiate or enhance the microbial degradation of contaminants. Biological processes depend on site-specific conditions and are highly variable. ISB is generally more effective in degrading organic contaminants than inorganic contaminants.

ISB may be capable of completely degrading and detoxifying organic contaminants. It does not involve the removal, transport, and disposal of impacted sediment and therefore may cost less than other remedial options (e.g., dredging and disposal). One of the important limitations to the effectiveness of ISB is that the higher the molecular weight of the organic contaminants, the greater the partitioning to sorption sites on sediment particles and the lower the contaminant availability to microorganisms. Degradation rates also vary with depth in sediment, partly due to the change from aerobic to anaerobic conditions. These changes frequently occur at depths of a few millimeters to a few centimeters, where sediment has substantial organic content and conditions are quiescent, and may also occur at deeper locations in some circumstances. Longer residence times of contaminants in the sediment also usually result in increased sequestration. These processes reduce the availability of the organic compounds to microorganisms and therefore reduce the extent and rates of biodegradation (U.S. EPA 2005). A long-term monitoring plan may be needed to document the reduction in contaminant concentrations after ISB implementation. A bench-scale or pilot-scale ISB treatability test would be required prior to full-scale implementation.

In Situ *Physical Treatment*

In situ physical treatment usually involves the solidification, stabilization, or sequestration of contaminants by adding binding agents (e.g., Portland cement, fly ash, limestone, or grout) to the surface of the sediment to encapsulate the contaminants in or under a solid matrix and/or to chemically alter the contaminants by converting them into a less bioavailable, less mobile, or less toxic form. *In situ* physical treatment may be effective in binding or encapsulating both organic and inorganic contaminants.

In situ physical treatment does not involve the removal, transport, and disposal of impacted sediment and therefore may cost less than other remedial options. However, *in situ* physical treatment does not destroy the contaminants in the sediment, but rather binds or contains them in a less mobile and bioavailable form. Binding agents may alter the oxidation-reduction conditions of the sediment, which may increase the solubility or mobility of certain contaminants. A monitoring plan may be needed to ensure the integrity of the solidified/stabilized treatment area. A bench-scale or pilot-scale ISB treatability test would be required prior to full-scale implementation.

In Situ *Chemical Treatment*

In situ chemical treatment induces chemical reactions to break down and destroy organic contaminants in sediment. Nanoscale iron (synthesized nanometer-size zero-valent iron particles) amendment is an example of an *in situ* chemical treatment. Nanoscale iron can be used to chemically reduce and dechlorinate halogenated organic contaminants. In the laboratory, nanoscale iron reduction of PCBs has led to their complete dechlorination (Gardner and Ausilio 2003). However, microscale (i.e., micrometer-size) zero-valent iron particles were found to be ineffective at dechlorinating PCBs, except at elevated temperatures and pressures (Yak et. al. 2000). Nanoscale iron reduction of other organic compounds and metals is untested (Battelle 2005). In addition, since nanoscale iron amendment has not been tested in the field, a bench-scale or pilot-scale treatability test would be required prior to full-scale implementation. A long-term monitoring plan may be needed to document the reduction in contaminant concentrations after nanoscale iron treatment.

4.3.8.2 EFFECTIVENESS

Most techniques for *in situ* treatment of sediment are in the early stages of development, and few methods are currently commercially available. Experiences gained to date in experimental or small-scale applications have indicated that technical limitations to the effectiveness of available *in situ* treatments continue to exist. *In situ* remedies relying on the addition of required substrates, nutrients, reagents, catalysts, or binding agents have been developed for some contaminants, but developing an effective delivery system to add and mix the needed levels of these materials to impacted sediment is more problematic (U.S. EPA 2005).

The overall effectiveness of *in situ* treatment processes depends on site-specific conditions and is highly variable. ISB would only be potentially effective in degrading organic contaminants. *In situ* physical treatment might be effective in binding or encapsulating both organic and inorganic contaminants. Since *in situ* chemical treatments such as nanoscale iron amendment have not been tested in the field, their effectiveness in treating organic and inorganic contaminants is uncertain.

4.3.8.3 IMPLEMENTABILITY

Since implementation methods for *in situ* treatment of sediment have not been thoroughly developed, the implementability of these technologies is not completely known. The materials and equipment needed to implement *in situ* treatment are limited in availability.

Bench-scale and pilot-scale testing would be necessary prior to full-scale implementation of any *in situ* treatment.

4.3.8.4 COST

Since *in situ* treatment technologies do not involve the removal, transport, and disposal of impacted sediment, they may cost less than other remedial options (e.g., dredging and off-site disposal). The cost would depend on the size of the treatment area and the type and volume of reagents, amendments, or binding agents required. The determination of the actual cost of an *in situ* treatment would require a bench-scale or pilot-scale test.

4.3.8.5 CONCLUSION

The effectiveness and implementability of most *in situ* treatment technologies are not completely known at this time. Among the *in situ* treatment options, physical treatment is expected to be the most effective in addressing the organic and inorganic contaminants in sediment at IR Site 24. *In situ* physical treatment is retained for further evaluation. ISB and *in situ* chemical treatment are eliminated from further consideration based on low effectiveness for inorganic constituents and low implementability.

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Section 5
DEVELOPMENT AND SCREENING OF REMEDIAL ALTERNATIVES

The technologies and associated process options retained after the screening evaluation in Section 4 were assembled into remedial alternatives to address the COCs identified in sediment at IR Site 24. Many of the remedial alternatives for sediment involve a combination of the general response actions screened in Section 4. The alternatives represent a range of technically feasible remedial responses to address the sediment contaminants in the AOEC at the site.

5.1 DEVELOPMENT OF REMEDIAL ALTERNATIVES

Remedial alternatives for sediment at IR Site 24 were developed on the basis of RAOs presented in Section 3, requirements of CERCLA and the NCP, and, to the extent practicable, applicable U.S. EPA technical guidance (U.S. EPA 1988, 2005). CERCLA Section 121(b) identifies the following statutory preferences for remedial actions.

- Preferred remedial actions are those involving treatment that permanently and significantly reduce the volume, toxicity, or mobility of site-related contaminants.
- The least favored remedial action is off-site transport and disposal without treatment of hazardous substances or contaminated materials when practical treatment technologies are available.
- Remedial actions using permanent solutions, alternative treatment technologies, or resource recovery technologies should be assessed where appropriate.

The NCP states that a range of remedial alternatives should be developed in the FS process (40 C.F.R. § 300.430[e]). Alternatives may vary in the degree of treatment employed (e.g., in the quantity of material treated or the percent reduction of contaminant concentrations) as well as in the types and quantities of residuals and untreated material remaining on-site requiring long-term management. Alternatives that achieve RAOs in varying lengths of time using one or more different technologies may also be considered.

The criteria regarding eventual selection of a preferred remedial action were also considered (U.S. EPA 1988). The preferred remedial action(s) will be presented in the PP. According to U.S. EPA technical guidance, the preferred remedial action should:

- protect human health and the environment,
- meet contaminant-specific ARARs and be consistent with location- and action-specific ARARs,
- be cost-effective,
- use permanent solutions and alternative treatment technologies to the maximum extent practicable, and
- satisfy the preference for treatment as a principal element of the remedial action to reduce the toxicity, mobility, or volume of contaminants.

The FS may also include alternatives that do not involve treatment. Due to the limited number of remediation methods available to address contaminated sediment, treatment typically is not a significant element of sediment site remedies (U.S. EPA 2005). In these cases, human health and the environment would be protected by using engineering controls to prevent or control exposure to site contaminants. As necessary, ICs would be included as part of a comprehensive remedial alternative for continued protectiveness of the response action.

Typically, under U.S. EPA guidance for conducting an RI/FS (U.S. EPA 1988) at a site with interacting media (e.g., sediment being a potential source of surface water contamination), media-specific remedial alternatives are combined into site wide alternatives, resulting in considerably more potential remedial alternatives to be evaluated. At IR Site 24, interactions between sediment and surface water appear to be limited and COCs in surface water do not pose an unacceptable risk to human health and the environment; therefore, only remedial alternatives addressing sediment are presented and evaluated in this FS Report.

As discussed in Section 4 and summarized in Table 4-3, the following process options were retained for further evaluation as components of the remedial alternatives:

- no action
- ICs
- sediment monitoring
- MNR
- sediment removal/dredging
- thin-layer capping
- *in situ* physical treatment
- several disposal options for sediment and water

These process options are grouped or used individually as six remedial alternatives in this FS Report (Table 5-1) and are presented below. These six remedial alternatives were developed to provide risk management decision makers a range of options with which to address sediment contamination in the AOEC at IR Site 24.

- Alternative 1 – no action
- Alternative 2 – ICs
- Alternative 3 – MNR with ICs
- Alternative 4 – thin-layer capping with ICs
- Alternative 5 – sediment removal/dredging
- Alternative 6 – *in situ* grouting with ICs

Remedial action for sediment in the AOEC is assumed to be necessary to ensure that sediments under the wharf road do not result in unacceptable exposure of ecological receptors to COCs. One potentially undesirable scenario could result if sediments in the AOEC are disturbed and allowed to disburse into the open-water area. Where contaminated sediment remains in place, ICs are included to prevent such disturbance. One alternative that includes only ICs (Alternative 2) and a second alternative with both ICs and an MNR component (Alternative 3) are included in the FS Report.

Three more active alternatives were developed to evaluate treatment approaches for the COCs (Figure 3-1). Alternative 4 (thin-layer capping with ICs) was designed to evaluate the placement of a covering of clean material over contaminated sediment that remains in place. Alternative 5 (sediment removal/dredging) was designed to evaluate a means of removing contaminated sediment from the bay. Alternative 6 (*in situ* grouting with ICs) was designed to evaluate immobilization of contaminated sediment by grouting it in place.

5.1.1 Alternative 1 – No Action

For the no action remedial alternative, no action of any type would be conducted to mitigate potential risks associated with impacted sediment at IR Site 24. This alternative, required by the NCP for inclusion in the FS Report, serves as a basis against which other sediment remedial alternatives may be compared. There are no costs associated with this alternative.

5.1.2 Alternative 2 – ICs

Alternative 2 would rely on ICs to prevent disturbance and dispersion of impacted sediment from the AOEC underneath the wharf road into the open-water area. ICs would remain in place until the Navy and regulatory agencies agree that the site no longer posed an unacceptable risk to ecological receptors.

ICs would be put in place at IR Site 24 to:

- prohibit disturbance to and resuspension of impacted sediment by restricting future dredging and construction activities in the AOEC without prior approval from the Navy and regulatory agencies, and
- prohibit removal of the wharf road (including land-use restriction/structure maintenance agreements) without prior approval from regulatory agencies and the Navy.

Five-year reviews would be included to evaluate the continued protectiveness of the ICs for this alternative. Time until RAOs are achieved would not be known for this alternative. For cost-estimating purposes, ICs are assumed to be in place for 30 years for this alternative.

5.1.3 Alternative 3 – MNR With ICs

Alternative 3 would rely on natural recovery processes to continue to isolate impacted sediment and reduce exposure of ecological receptors to COCs in sediment over time at the AOEC. ICs would be implemented as part of this alternative.

A long-term MNR program, including 5-year reviews, would be implemented to confirm that natural processes (e.g., sediment deposition) were occurring and to track remediation progress. ICs would be included similar to those described for Alternative 2 to prohibit disturbance of sediment in the AOEC and to prohibit actions that would interfere with the MNR activities. In addition, Alternative 3 would include a predesign investigation to refine the extent of COCs in sediment at concentrations exceeding preliminary RGs, and a sediment-monitoring program with periodic sampling to assess sediment quality and sedimentation rate over time. In addition, the predesign investigation would include collection of surface water samples in areas with elevated cadmium concentrations to evaluate cadmium efflux from sediment into overlying water. If the predesign investigation results for cadmium efflux analysis indicated potential risk, then additional cadmium efflux sampling would be performed as part of the post-remediation monitoring program.

Once sediment-monitoring results indicated that RAOs were achieved and that ICs were no longer warranted, the MNR program and ICs would be discontinued. For cost-estimating purposes, the MNR program and ICs are assumed to be in place for 30 years for this alternative.

5.1.4 Alternative 4 – Thin-Layer Capping With ICs

Alternative 4 consists of installation of a thin-layer cap (up to 12 inches thick) where concentrations of COCs in sediment are present above preliminary RGs (Figure 3-1). In addition to thin-layer capping, Alternative 4 includes ICs. A predesign investigation would be performed under Alternative 4 to refine the extent of COCs in sediment at concentrations exceeding preliminary RGs and to determine cap placement locations. In addition, the predesign investigation would include collection of surface water samples in areas with elevated cadmium concentrations to evaluate cadmium efflux from sediment into overlying water. If the predesign investigation results for cadmium efflux analysis indicated potential risk, then additional cadmium efflux sampling would be performed as part of the post-remediation monitoring program. No core samples would be collected as part of this alternative.

The thin-layer capping would provide physical isolation of contaminated sediment from potential ecological receptors. A cap thickness of 12 inches (30 cm) is considered sufficient compared to a typical biologically active zone of 4 to 6 inches (10 to 15 cm) (Thoms et al. 1995). The placement of a thin-layer cap would also accelerate natural recovery processes and reduce ecological exposure to contaminated sediment. Thin-layer capping includes at least a temporary destruction of the benthic community and habitat within the cap area.

A long-term monitoring program, including 5-year reviews, would be implemented to verify that the thin-layer cap was performing as intended, and to track progress of natural recovery processes. Once sediment monitoring results indicated that RAOs were achieved and that ICs were no longer warranted, the ICs would be discontinued. The ICs would be similar to those described for Alternative 3. For cost-estimating purposes, the long-term monitoring program and ICs are assumed to be in place for 30 years for this alternative.

5.1.5 Alternative 5 – Sediment Removal/Dredging

Alternative 5 would employ dredging or a similar technology to remove sediment with COC concentrations exceeding preliminary RGs (Figure 3-1). For purposes of this alternative, "dredging" refers to conventional mechanical dredging or other methodology for removal of sediment. After waste profiling, the removed sediment would be transported and disposed in an appropriate off-site landfill. Removal of impacted sediment would be verified through confirmation sampling. A predesign investigation would be performed under Alternative 5 to define the extent of COCs in sediment at concentrations exceeding preliminary RGs and to determine dredging locations and depths.

Because absolute precision is difficult to achieve in subaqueous dredging, Alternative 5 assumes that sediment removal will remove contaminated sediment to the extent feasible. Sediment immediately adjacent to the wharf road pilings might not be removed. A review might be required to determine the stability of the structures (e.g., wharf road, quay wall, piers, foundations, and pilings) in and near the proposed dredging area. The design of additional supports to preserve structural stability of the wharf road during dredging operations, if required, would be considered in the detailed design stage. Dredging would be performed generally to the nearest foot, with sediment removal depths ranging from 1 to 2 feet below the sediment surface to ensure that the desired thickness is completely removed. Based on the proposed dredging areas and depths, the volume of impacted sediment is 1,000 bcy, as described in Section 3.5. With an over-dredge allowance of approximately 500 bcy, the estimated total volume of dredged sediment for FS purposes is 1,500 bcy.

No ICs would be implemented under this alternative. Confirmation sampling would be performed at the end of the sediment removal activities in order to ensure that the remediation is complete. No long-term monitoring would be required for this alternative.

After sediment removal and confirmation sampling activities were completed, clean, washed granular backfill material from an off-site source would be placed in the area to maintain the stability of the structures in the AOEC. Like thin-layer capping, sediment removal would involve at least a temporary destruction of the benthic community and habitat within the remediation area.

A remedial action closeout report would be prepared following the completion of the remediation activities. Because the assumed total duration of this alternative is less than 5 years, a 5-year review is assumed not to be required. However, the Navy would conduct a 5-year review for this site if the selected remedy was not completed when the 5-year review was due. For cost-estimating purposes, the duration of this alternative is assumed to be approximately 1 year.

5.1.6 Alternative 6 – In Situ Grouting With ICs

Alternative 6 would implement *in situ* grouting in the AOEC where concentrations of COCs in sediment exceed preliminary RGs (Figure 3-1). In addition to *in situ* grouting, Alternative 6 would include ICs. A predesign investigation would be performed under

Alternative 6 to delineate the treatment area and to determine *in situ* grouting placement locations.

In situ grouting would provide solidification, stabilization, and/or sequestration of contaminants by adding Portland cement, fly ash, limestone, or other additives to the sediment. Contaminants would then be encapsulated in a solid matrix and converted into a less bioavailable, less mobile, or less toxic form. Like thin-layer capping and dredging, *in situ* grouting would include at least a temporary destruction of the benthic community and habitat within the remediation area.

Confirmation sampling would be performed at the end of the grouting activities in order to verify that the contaminated sediment has been properly solidified/stabilized. A monitoring program, including 5-year reviews, would be implemented to ensure the integrity of the solidified/stabilized treatment area. Once monitoring results indicated that ICs were no longer warranted, the ICs would be discontinued. The ICs would be similar to those described for Alternative 3.

5.2 SCREENING OF REMEDIAL ALTERNATIVES

When multiple viable remedial alternatives exist, they may be refined and screened to reduce the number of alternatives to be analyzed in detail (U.S. EPA 1988). This screening step aids in streamlining the FS process while assuring that the most promising alternatives are being considered.

In accordance with U.S. EPA criteria, information available at the time of screening is used primarily to identify differences among the various alternatives and to evaluate each alternative's effectiveness, implementability, and cost. Only the alternatives judged to be the best or most promising on the basis of these evaluation factors are retained for further consideration unless additional information becomes available that indicates further evaluation is warranted (U.S. EPA 1988).

For this FS Report, Alternative 6 is eliminated because *in situ* grouting has uncertain effectiveness, is in the early stages of development, and few delivery methods are currently commercially available. All other alternatives described in this section were retained for detailed analysis (Section 6). The screening results for remedial alternatives for sediment are presented in Table 5-2.

Section 6
DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

This section provides a description and detailed analysis of each of the remedial alternatives retained following the initial screening in Section 5. The detailed analysis consists of evaluation of each alternative's performance against NCP criteria. The retained remedial alternatives are evaluated in this section to provide decision makers a range of alternatives to address sediment in the AOEC at IR Site 24.

The following remedial alternatives for sediment are evaluated in this section:

- Alternative 1 – no action
- Alternative 2 – ICs
- Alternative 3 – MNR with ICs
- Alternative 4 – thin-layer capping with ICs
- Alternative 5 – sediment removal/dredging

6.1 REVIEW OF CRITERIA

The following nine criteria are stipulated in the NCP at 40 C.F.R. § 300.430(e)(9)(iii) for the evaluation of remedial alternatives under CERCLA:

Threshold criteria:

1. overall protection of human health and the environment
2. compliance with ARARs

Primary balancing criteria:

3. long-term effectiveness and permanence
4. reduction of toxicity, mobility, or volume through treatment
5. short-term effectiveness
6. implementability
7. cost

Modifying criteria:

8. state acceptance
9. community acceptance

CERCLA Section 121(d) and the NCP at 40 C.F.R. § 300.430(f)(1)(ii) require that a cleanup remedy must protect human health and the environment and comply with ARARs unless justification to waive a specific ARAR is provided in the ROD. In other words, both threshold criteria must be satisfied for a remedial alternative to be eligible for selection unless an ARARs waiver applies. The remedial alternatives do not have to meet all five balancing criteria, although it is preferred. Evaluation against modifying criteria is the final test in determining whether the state and the community find the alternative acceptable.

The nine NCP criteria are further defined by subcriteria and other factors (U.S. EPA 1988). The following sections explain the nine NCP criteria and summarize the relevant subcriteria and other factors.

6.1.1 Overall Protection of Human Health and the Environment

This criterion assesses the extent to which an alternative protects human health and the environment, considering site characteristics and expected risk reduction. Evaluation of the overall protection of human health and the environment afforded by each alternative draws on assessments made under several other NCP criteria, especially short-term effectiveness, long-term effectiveness and permanence, and compliance with ARARs.

The following issues are addressed for each alternative under this criterion:

- reduction in risk to human health and the environment (ecological risk)
- ability to achieve general response objectives or RAOs for sediment at IR Site 24

6.1.2 Compliance With ARARs

This criterion examines whether an alternative would comply with federal and state ARARs, as defined by CERCLA Section 121 and identified for IR Site 24 in Appendix A. Potential chemical- and location-specific ARARs were described in Section 3.3. Potential action-specific ARARs for each alternative are described in this section. When an ARAR is not met, the basis for justifying one of the six waivers allowed under CERCLA should be discussed.

6.1.3 Long-Term Effectiveness and Permanence

This criterion examines the impact of a remedial alternative in the long term, defined in U.S. EPA guidance as the risk remaining after response objectives have been met (U.S. EPA 1988). A remedial alternative for IR Site 24 is evaluated relative to its long-term effectiveness and permanence by considering the following four factors:

- magnitude of the residual risk to ecological receptors from remaining affected sediment at the completion of remedial activities
- type, degree, and adequacy of long-term management (including ICs, monitoring, and O&M) required for affected sediment remaining at the site
- long-term reliability of engineering controls and ICs to provide continued protection to ecological receptors from affected sediment
- the potential need to replace components of the remedy and the continuing need for repairs or maintenance

6.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

According to CERCLA, preferred remediation alternatives use treatment technologies that permanently and significantly reduce the toxicity, mobility, or volume of hazardous substances (compared to baseline levels [i.e., the no action alternative]). For IR Site 24, this would mean using treatment technologies that accomplish one or more of the following:

- reduction in exposure of ecological receptors to impacted sediment
- immobilization or removal of COCs in sediment
- reduction in the total mass of COCs in sediment
- reduction in the volume of COC-impacted sediment
- irreversible reduction in mobility of COCs

Alternatives that do not use treatment technologies such as sediment removal and off-site disposal of impacted sediment without treatment to achieve these goals do not significantly reduce the toxicity, mobility, or volume of COCs through treatment.

Evaluation of alternatives for reduction of toxicity, mobility, or volume through treatment includes the following considerations for IR Site 24:

- treatment processes used
- amount of hazardous materials to be treated and strategy for addressing the principal threats at the site
- degree of expected reduction in toxicity, mobility, or volume measured as a percentage of baseline levels
- degree to which the treatment is irreversible
- type and quantity of treatment residuals

6.1.5 Short-Term Effectiveness

This criterion considers how an alternative affects human health and the environment during remediation (i.e., the short term). "Short term" is defined as the time required to plan, design, construct, and operate a system of remediation until response objectives (the RAOs) are met (U.S. EPA 1988). The following factors are considered for IR Site 24:

- short-term risks that might be imposed on the community (e.g., accommodation of equipment maneuverability and transportation of dredged sediment and other materials to and from the site)
- potential impacts on workers during construction and O&M as well as the effectiveness and reliability of the protective measures that would be taken
- potential environmental impacts of the remedial action and the effectiveness and reliability of mitigation measures that would be taken during implementation
- amount of time required before protection is achieved (i.e., the duration of the short term)

6.1.6 Implementability

This criterion evaluates the technical and administrative feasibility of an alternative. The availability of required equipment, materials, and services is also considered. When assessing implementability of alternatives at IR Site 24, the following factors are considered:

- technical feasibility, which refers to the relative ease of implementing or completing an action based on site-specific constraints, including the use of established technologies. The following issues are considered:
  - constructability of components necessary for the alternative
  - operational reliability, or the likelihood that a technology would meet specified efficiency levels or performance goals
  - ability of the owner to undertake future remedial actions that may be required and difficulty of implementing such actions
  - ability of the owner to monitor the effectiveness of the remedy
- administrative feasibility, which includes the ability (as well as the time) to obtain approvals from governmental bodies
- availability of services and materials required to implement the alternative, including the following:
  - capacity and location of off-site TSD services
  - equipment (such as heavy construction equipment) and specialists needed
  - time needed to develop new or innovative technologies under consideration, including the time required for bench-scale and pilot-scale tests
  - potential for obtaining competitive construction bids, a factor that may be particularly important for innovative technologies

6.1.7 Cost

Procedures outlined in U.S. EPA guidance (U.S. EPA 1987, 1988, 2000) have been followed in developing cost estimates for each retained remedial alternative. These cost estimates are based on the conceptual engineering designs. All estimates include capital costs and O&M costs and are expressed as present value in terms of January 2007 dollars (Appendix B). The details of the alternatives (e.g., frequency of sediment sampling and analysis parameters) would be determined in the remedial design phase. The assumptions used in estimating costs in this FS Report are described in Appendix B. The estimated costs presented in this FS Report are solely for the purpose of comparing alternatives; these costs should not be used for budgetary or planning purposes, because actual costs may change based on the final design and the length of time ICs and monitoring requirements are in place.

6.1.8 State Acceptance

This criterion evaluates the remedial alternatives with respect to the concerns of state regulatory agencies. The state of California will review and comment on this FS Report; state responses will be considered when revising this report. State comments will also be considered in finalizing the PP and ROD. The criterion of state acceptance for each retained alternative is discussed in Section 7.

6.1.9 Community Acceptance

This criterion assesses issues of concern to the community for each remedial alternative. Comments will be solicited from community members during the public review period for this FS Report and considered in finalizing this document, including any necessary changes or additions to remedial alternatives. A summary of public comments and responses will be included in the ROD. Although community acceptance will be evaluated after the public comment period for the PP, this criterion is described in Section 7 for each retained alternative.

6.2 ALTERNATIVE 1 – NO ACTION

Alternative 1 is the no action alternative for impacted sediment at the AOEC. Per the NCP (40 C.F.R. § 300.430[e][6]), this alternative must be evaluated in the same manner as the other remedial response actions considered in this FS Report.

6.2.1 Description of Alternative

The no action alternative provides a baseline against which other potential remedial alternatives are compared. Alternative 1 involves no engineered remediation measures, administrative controls, or monitoring of impacted sediment at the AOEC. This alternative would not include any activities to monitor natural recovery processes or to implement ICs to prevent disturbance of contaminated sediment in the AOEC. If selected, this action would be considered a final remedy for the site. No periodic reviews would be conducted to verify the protectiveness of this alternative.

6.2.2 Evaluation by Criteria

This subsection provides a discussion of Alternative 1 relative to the NCP threshold criteria. As discussed below, this alternative does not meet the threshold criterion of overall protection of human health and the environment. Therefore, an evaluation against the balancing criteria is not necessary and was not performed.

6.2.2.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternative 1 would not offer remedial measures or protection of human health and the environment to alleviate potential ecological risks associated with COCs in sediment in the AOEC. This alternative would leave impacted sediment on-site and provide no measures to limit potentially unacceptable ecological exposure or evaluate whether natural processes that could reduce sediment contamination were occurring. The RI Report concluded that there are no complete human-health exposure pathways (Battelle et al. 2007). However, future development of the site would not be restricted under this alternative; therefore, exposure routes could develop in the future without land-use restrictions. Under this alternative, impacted sediment would be left in place without any mitigation, treatment, or monitoring; therefore, potentially unacceptable risks to ecological receptors would remain. For these reasons, this alternative is not considered protective of human health and the environment.

6.2.2.2 COMPLIANCE WITH ARARs

According to the NCP, the no action alternative must be evaluated in the same manner as other proposed remedial action alternatives. There are no ARARs that would apply under the no action alternative; according to CERCLA Section 121, the requirement to meet ARARs applies only when a response action is taken.

6.3 ALTERNATIVE 2 – ICs

Alternative 2 would rely on ICs to minimize disturbance and dispersion of the impacted sediment from the AOEC into the open-water area. Five-year reviews would be included to evaluate the continued protectiveness of the ICs for this alternative. Time until RAOs are achieved would not be known for this alternative. For cost-estimating purposes, ICs are assumed to be in place for 30 years.

6.3.1 Description of Alternative

Alternative 2 includes the following components:

- ICs to minimize disturbance and dispersion of impacted sediment from the AOEC into the open-water area
- periodic reviews

6.3.1.1 ICs

Under Alternative 2, ICs have been assumed for the purposes of this FS Report; however, the actual ICs to be implemented at IR Site 24 would be established in the ROD and subsequent remedial design/remedial action documentation. ICs would remain in place until RAOs were achieved and the Navy and regulatory agencies agreed that the site no longer posed potentially unacceptable ecological risk.

ICs would be put in place at IR Site 24 to:

- prohibit disturbance of sediments in the AOEC, and
- prohibit removal of the wharf road (including land-use restriction/structure maintenance agreements) without prior approval from regulatory agencies and the Navy.

The Navy would develop and implement an ICs program utilizing the strategies described in Section 4.3.2. The final ICs would be geared towards prohibiting removal of the wharf road structure and/or its pilings without prior approval from agencies and the Navy. The effectiveness of the ICs would be reviewed periodically as part of the CERCLA 5-year review process. ICs would remain in place until the regulatory agencies and the Navy agreed that ICs are no longer required.

6.3.1.2 REVIEWS AND REPORTING

For Alternative 2, it is assumed that five 5-year reviews would be prepared, pursuant to CERCLA Section 121 and the NCP requirements. Reviews would be documented in summary reports issued to the appropriate regulatory agencies. A closeout report would be prepared at the end of the ICs program to document regulatory agency and Navy agreement that ICs are no longer required.

6.3.2 Evaluation by Criteria

Evaluation of Alternative 2 using NCP threshold criteria and balancing criteria follows. The evaluation relative to the balancing criteria is summarized in Table 6-1. A cost estimate summary is presented in Table 6-2. The NCP modifying criteria are discussed in Section 7.

6.3.2.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternative 2 is considered protective of human health and the environment. ICs would be implemented to minimize disturbance of impacted sediment. The potential for risk in the AOEC is expected to be limited in scope due to the small size of the area and the location of the sediment shelf under the roadway, where exposure to receptors is likely to be minimal. Time until RAOs were achieved would not be known for this alternative. U.S. EPA does not concur that Alternative 2 meets the threshold protectiveness criterion.

6.3.2.2 COMPLIANCE WITH ARARs

Alternative 2 is expected to meet potential chemical-specific, location-specific, and action-specific ARARs. Potential ARARs associated with this alternative have been evaluated and identified in Appendix A. There are no federal ARARs for ICs. The substantive provisions of the following requirements have been accepted by the Navy as potentially relevant and appropriate ARARs for implementing ICs to restrict use of property:

- *California Civil Code*, Land Use Controls § 1471
- *California Health and Safety Code*, Land Use Controls §§ 25202.5, 25222.1, 25232(b)(1)(A)–(E), 25233(c), 25234, and 25355.5
- Cal. Code Regs. tit. 22, § 67391.1

6.3.2.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

Under Alternative 2, ICs would be implemented to prohibit disturbance and dispersion of impacted sediment under the wharf road. The long-term effectiveness of ICs would depend on continued adherence to them. For cost-estimating purposes, Alternative 2 assumes that ICs would be implemented for 30 years.

6.3.2.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

Alternative 2 would not involve a reduction of toxicity, mobility, or volume through treatment. This alternative would not include sediment sampling and analysis to provide information about COC concentrations with time. Therefore, the reduction of toxicity, mobility, or volume of COCs in sediment would not be verified and would not be assumed to occur.

6.3.2.5 SHORT-TERM EFFECTIVENESS

Implementation of ICs under Alternative 2 would pose no risk to workers, the community, and the environment. ICs could be put in place in a short period of time to prohibit disturbance of sediment in the AOEC. Time until RAOs are achieved is unknown for this alternative.

6.3.2.6 IMPLEMENTABILITY

All activities associated with Alternative 2 would be easily implementable.

6.3.2.7 COST

The present-value cost for Alternative 2 is approximately $426,000 (Table 6-2). Major cost components for this alternative are associated with administering and monitoring of ICs. For cost-estimating purposes, it is assumed that the duration of this alternative would be 30 years. Appendix B provides cost backup and supporting details.

6.4 ALTERNATIVE 3 – MNR WITH ICs

Alternative 3 would rely on natural recovery processes to continue to isolate impacted sediment and reduce ecological exposure to COCs in sediment over time at the AOEC. A long-term MNR program, including periodic reviews, would be implemented to confirm that natural processes (primarily sediment deposition) were occurring and to track remediation progress. ICs would be included that are similar to those described for Alternative 2 to prohibit disturbance of sediment in the AOEC and to prohibit actions that would interfere with the MNR activities. For cost-estimating purposes, the duration of the MNR program and ICs under Alternative 3 is assumed to be 30 years. However, once sediment monitoring results indicated that RAOs were achieved and that ICs were no longer warranted, the regulatory agencies and the Navy would determine whether the MNR program and ICs could be discontinued.

6.4.1 Description of Alternative

Alternative 3 includes the following components:

- a predesign investigation to define the extent of COCs in sediment at concentrations exceeding preliminary RGs
- a sediment monitoring program with periodic sampling to assess sediment quality over time

- ICs to prohibit disturbance of impacted sediment in the AOEC
- periodic reviews and reporting

For cost-estimating purposes, the duration of the MNR program and ICs under Alternative 3 is assumed to be 30 years.

6.4.1.1 PREDESIGN INVESTIGATION

A predesign investigation would be conducted to verify the extent of COCs in sediment at concentrations exceeding preliminary RGs and to serve as a baseline against which subsequent sediment monitoring results would be compared. The predesign investigation would be conducted either prior to the design or as the first step in the remediation. This predesign investigation is assumed for FS purposes to consist of the following components.

- Develop and obtain agency approval of a work plan.
- Perform a bathymetric survey in the AOEC to determine initial depth to sediment surface.
- Establish 18 permanent sampling stations so that repeated surveys/sampling conducted during the MNR program can be accurately compared (Figure 6-1 presents the proposed sampling locations).
- Collect and analyze one homogenized sediment sample across the exposure interval at each of the 18 permanent locations to assess the extent of COCs in sediment.
- Collect and analyze a core sediment sample from each of nine locations across the sediment interval and calculate the sedimentation rate from chemical and bathymetric survey data at the AOEC.
- Collect an assumed four surface water samples in areas with elevated cadmium for analysis to evaluate cadmium efflux from sediment into overlying water.

6.4.1.2 SEDIMENT MONITORING PROGRAM

Alternative 3 assumes that natural sedimentation and attenuation processes would continue to occur at IR Site 24 to reduce ecological exposure in the AOEC. In general, natural recovery would rely primarily on long-term natural sedimentation and covering of impacted sediment. This natural capping process, which has been documented in Seaplane Lagoon, would form a protective barrier over the sediment at IR Site 24 that would minimize resuspension of impacted sediment and limit exposure of ecological receptors to contaminants. The actual sedimentation rate at IR Site 24 is currently unknown; the sedimentation rate at nearby IR Site 17 (Seaplane Lagoon) has been estimated at approximately 0.6 to 0.7 inch (1.5 to 1.7 cm) per year (Battelle 2005). The sedimentation rate at the AOEC at IR Site 24 is probably similar to that estimated for Seaplane Lagoon, but is conservatively assumed for FS purposes to be at least one-half of the sedimentation rate in Seaplane Lagoon (i.e., approximately 0.3 inch or 0.8 cm per year). During the natural recovery processes, metals would be expected to remain bound to sediment by forming stable metal-sulfide precipitates, and then to be covered by cleaner natural sediment. Natural aerobic and anaerobic biodegradation processes would be expected to reduce the concentrations, bioavailability, and toxicity of organic contaminants.

Under Alternative 3, a MNR program would be developed and implemented at the AOEC to confirm that natural processes were occurring and to track remediation progress. The MNR program would include periodic bathymetric surveys and sediment sampling and analysis. It is assumed that the sediment exposure interval for ecological receptors is 0 to 10 inches. Sufficient sediment data are not currently available to predict the duration of the MNR program; however, using an assumed sedimentation rate of 0.3 inch per year, it is conservatively estimated that approximately 10 inches (25 cm) of fresh sediment would be deposited at the site in an approximately 33-year period. Therefore, for cost-estimating purposes, it is assumed that the duration of this alternative is 30 years.

The sediment monitoring program is assumed to include bathymetric surveys as well as sediment sampling and analysis every 5 years for the duration of this alternative. The MNR program would be reviewed and optimized based on the survey and analytical results. The final monitoring program would be developed in the remedial design stage.

If predesign investigation results for cadmium efflux analysis indicate potential risk, then additional cadmium efflux sampling will be performed as part of the post-remediation monitoring program.

6.4.1.3 ICs

ICs would be put in place at the AOEC for Alternative 3 until RAOs were achieved, and the Navy and regulatory agencies agreed that the site no longer poses a potentially unacceptable ecological risk. The actual ICs to be implemented at the AOEC would be established in the ROD and subsequent remedial design/remedial action documentation. The scope of the ICs would be similar to that described for Alternative 2 (Section 6.3.1.1), with the added objective of prohibiting the alteration, disturbance, or removal of monitoring stations during the remedial action.

6.4.1.4 REVIEWS AND REPORTING

For Alternative 3, it is assumed that the activities and findings of the predesign investigation would be summarized in the remedial design documentation. For the purposes of this FS Report, it is assumed that five 5-year reviews would be prepared pursuant to CERCLA Section 121 and the NCP requirements and a closeout report would be prepared at the end of the MNR program and ICs. Results of periodic monitoring would be reported in conjunction with the 5-year reviews. Reviews would be documented in summary reports issued to the regulatory agencies.

6.4.2 Evaluation by Criteria

Evaluation of Alternative 3 using NCP threshold criteria and balancing criteria follows. The evaluation relative to the balancing criteria is summarized in Table 6-1. A cost estimate summary for this alternative is presented in Table 6-3. The NCP modifying criteria are discussed in Section 7.

6.4.2.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternative 3 is considered protective of human health and the environment. Natural recovery processes are expected to isolate impacted sediment and reduce ecological exposure to COCs in sediment over time. ICs would be implemented to minimize disturbance of impacted sediment and to prohibit actions that would interfere with the MNR activities. ICs would remain in place until RAOs were achieved and the Navy and regulatory agencies agreed that the site no longer posed potentially unacceptable ecological risk. Sediment sampling and analysis and periodic reviews would track the MNR progress and provide information to support future remedial action decisions.

6.4.2.2 COMPLIANCE WITH ARARs

Alternative 3 is expected to meet potential chemical-specific, location-specific, and action-specific ARARs. Potential ARARs associated with this alternative have been evaluated and identified in Appendix A. Sampling waste and other investigation-derived waste (IDW) generated during the collection of sediment samples would be subject to the substantive provisions of potential RCRA ARARs to determine whether such wastes should be classified as hazardous. This determination would be made at the time the waste was generated. The substantive provisions of potential waste management ARARs for storing the wastes prior to off-site disposal would be followed if the wastes were found to be RCRA or non-RCRA hazardous waste.

Potential ARARs associated with ICs are the same as those described for Alternative 2 (Section 6.3.2.2).

6.4.2.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

Under Alternative 3, ongoing natural recovery processes would be expected to continue to isolate impacted sediment and reduce COC concentrations in sediment over time. The actual sedimentation rate at IR Site 24 is currently unknown; the sedimentation rate at nearby IR Site 17 (Seaplane Lagoon) has been estimated at approximately 0.6 to 0.7 inch (1.5 to 1.7 cm) per year (Battelle 2005). The sedimentation rate at the AOEC at IR Site 24 is probably similar to that estimated for Seaplane Lagoon, but is conservatively assumed for FS purposes to be at least one-half of the sedimentation rate in Seaplane Lagoon (i.e., approximately 0.3 inch or 0.8 cm per year). It is assumed that the sediment exposure interval for ecological receptors is 10 inches. Sufficient sediment data are not currently available to predict the duration of the MNR program; however, using an assumed sedimentation rate of 0.3 inch per year, it is conservatively estimated that 10 inches (25 cm) of fresh sediment would be deposited at the site in approximately 33 years. Therefore, for cost-estimating purposes, it is assumed that the duration of this alternative is 30 years. Sediment sampling and analysis, bathymetric surveys, and periodic reviews would be performed to evaluate the sedimentation rate, lines of evidence, and progress of MNR to continue reducing ecological risk.

For cost-estimating purposes, it is assumed that ICs under Alternative 3 would be implemented for 30 years. However, once sediment monitoring results indicated that RAOs were achieved and that ICs were no longer warranted, the regulatory agencies and the Navy would determine whether the ICs and monitoring program could be discontinued for Alternative 3.

6.4.2.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

Alternative 3 would not involve reduction of toxicity, mobility, or volume through active treatment. The toxicity, mobility, or volume of COCs in sediment would be reduced with time through passive natural processes. This alternative would not include measures to affect the rate at which these natural processes accomplish ecological risk reduction. Sediment sampling and analysis would provide information to evaluate the reduction in COC concentrations in sediment over time.

6.4.2.5 SHORT-TERM EFFECTIVENESS

Implementation of the components of Alternative 3 would not be expected to have adverse effects on site workers, the surrounding community, or the environment. ICs could be put in place in a short period of time to prohibit disturbance of sediment in the AOEC.

Time until protection is achieved for Alternative 3 is assumed to be approximately 30 years, based on a sedimentation rate of 0.3 inch per year. For cost-estimating purposes, the duration of the MNR program and ICs under Alternative 3 is assumed to be 30 years. The estimated sedimentation rate and the resulting time until protection is achieved would be reassessed as part of the 5-year review process based on evaluation of monitoring data collected during the MNR period. ICs would remain in place until RAOs were achieved and the Navy and regulatory agencies agreed that the site no longer posed potentially unacceptable ecological risk.

6.4.2.6 IMPLEMENTABILITY

Alternative 3 would be easily implementable. Sediment sampling and analysis could be performed as demonstrated by previous sediment investigations at the site. Periodic sediment sampling activities and bathymetric surveying should not be incompatible with the potential reuse options; however, access to the area beneath the wharf road would need to be maintained to allow for sampling activities. Additionally, ICs would be easily implementable at the site.

6.4.2.7 COST

The present-value cost for Alternative 3 is approximately $1,130,000 (Table 6-3). Major cost components for this alternative are associated with the sediment monitoring program and monitoring of ICs. For cost-estimating purposes, it is assumed that the duration of this alternative is 30 years. Appendix B provides cost backup and supporting details.

6.5 ALTERNATIVE 4 – THIN-LAYER CAPPING WITH ICs

Alternative 4 consists of installation of a thin-layer cap over the impacted sediment in the AOEC at IR Site 24 where concentrations of COCs in sediment exceed preliminary RGs.

The placement of a thin-layer cap would accelerate natural recovery processes by providing physical isolation of contaminated sediment from potential ecological receptors. A cap thickness of 10 to 12 inches (25 to 30 cm) is considered sufficient compared to a typical biologically active zone of 4 to 6 inches (10 to 15 cm) (Thoms et al. 1995). In addition to thin-layer capping, Alternative 4 would also include ICs. The ICs would be similar to those described for Alternative 3. A long-term monitoring program, including periodic reviews, would be implemented to verify that the thin-layer cap is performing as intended, and to track progress of natural recovery processes. For cost-estimating purposes, the assumed duration of Alternative 4 would be 30 years. However, once sediment monitoring results indicated that RAOs were achieved and that ICs were no longer warranted, the regulatory agencies and the Navy would determine whether the ICs could be discontinued.

6.5.1 Description of Alternative

This alternative assumes that a thin-layer cap would be placed over existing contaminated sediment to prevent unacceptable ecological exposure in the AOEC. This alternative is included based on the following assumptions regarding cap construction and performance.

- Propeller scour is not expected to be a significant design concern because the AOEC is primarily under the wharf road and sediment disturbance by boat propellers is not expected to cause significant mobilization of contaminated sediment into the open-water area of IR Site 24.
- Erosion and wave action are not expected to have a significant adverse impact on cap performance. IR Site 24 is isolated by the breakwater (Figure 1-2), and the AOEC at the site is located in an area where these forces are not expected to mobilize cap components.
- No armoring of the cap is expected to be required. Armoring would be evaluated in the remedial design stage.
- Thin-layer capping is assumed to be performed by hydraulic means (using hoses) or using other equipment capable of accessing the AOEC under the wharf road.

Alternative 4 includes the following components:

- a predesign investigation to define the extent of COCs in sediment at concentrations exceeding preliminary RGs and to collect design information for use in cap design
- placement of a thin-layer cap
- ICs to prohibit disturbance of impacted sediment in the AOEC and/or damage to the cap
- sediment monitoring
- periodic reviews and reporting

6.5.1.1 PREDESIGN INVESTIGATION

The predesign investigation for Alternative 4 would be identical to the investigation described for Alternative 3, except that baseline sediment sampling would include 10 permanent sampling stations and 30 temporary sampling stations (a total of 40 sampling locations) with collection of one sample per location to determine cap placement locations. The predesign investigation would be conducted either prior to the design or as the first step in the remediation. No core samples would be collected as part of this alternative. Figure 6-1 presents the proposed sampling locations.

6.5.1.2 THIN-LAYER CAP

For Alternative 4, a thin-layer cap would be installed over the AOEC where concentrations of COCs in sediment exceed preliminary RGs. Thin-layer capping is a form of containment in-place and refers to placement of a cap over an *in situ* deposit of impacted sediment. Various types of thin-layer cap materials might be selected by the Navy for implementation at the AOEC at IR Site 24. The cap design details would be presented in the remedial design stage.

For cost-estimating purposes, it is assumed that a thin-layer cap would include clean, washed sand placed on top of the existing sediment at the AOEC (Figure 3-1). The thin-layer cap would be 10 to 12 inches thick over an assumed area of approximately 18,000 square feet. For cost-estimating purposes, a 12-inch-thick cap was assumed to account for variations in cap placement during implementation. A cap thickness of 10 to 12 inches (25 to 30 cm) is considered sufficient compared to a typical biologically active zone of 4 to 6 inches (10 to 15 cm) (Thoms et al. 1995). A preliminary thin-layer capping design is depicted on Figure 6-2. No armoring of the cap is assumed to be necessary. An estimated 700 bcy of cap material would be emplaced at the site using throwing conveyors or by hydraulic means. To reduce the transport of suspended sediment or cap material released during thin-layer capping activities, physical containment barriers such as silt curtains or screens would be used as necessary. Surface-water monitoring for turbidity would be performed during cap placement to ensure that capping operations did not disperse suspended sediment from the AOEC into the open-water area.

Before cap installation, the site would be assessed to identify the extent of debris in the cap area. Debris such as driftwood, trash, clothing, and other debris that has migrated into the area would be removed. Large debris such as concrete rubble and riprap would be left in place. No treatability tests or pilot-scale tests are included for this alternative.

6.5.1.3 ICs

ICs would be put in place under Alternative 4 until the regulatory agencies and the Navy agreed that ICs were no longer warranted. The actual ICs to be implemented at the AOEC would be established in the ROD and subsequent remedial design/remedial action documentation. The scope of the ICs would be similar to that described for Alternative 3 with the added objective of assessing the cap performance to confirm that it is functioning as intended.

6.5.1.4 MONITORING

For Alternative 4, two types of monitoring are included: construction monitoring and performance monitoring. These monitoring program elements would be developed in the remedial design phase.

Construction monitoring would be performed to confirm that the cap placement was consistent with design plans and specifications, and to verify that placement did not cause excessive disbursement of contaminated sediment outside of the AOEC. During construction, monitoring results would be used to identify modifications to design or construction techniques (if needed) and to accommodate any unavoidable field constraints. Construction monitoring would include interim and postconstruction cap material placement surveys to verify the thickness of the thin-layer cap across the AOEC.

Performance-monitoring elements of this alternative would be developed and implemented to ensure that the cap was not being eroded or significantly compromised by external forces (e.g., penetration by submerged aquatic vegetation, unexpected erosion due to tidal action or propeller scour, or excessive bioturbation). It would also include ongoing monitoring for possible recontamination of the cap surface and noncapped areas from these activities or other sources. Ten permanent location benchmarks would be established so that periodic surveys could be accurately compared. The performance monitoring program is assumed for FS purposes to include bathymetric surveys and sampling of surface sediment for the following analyses: metals, pesticides, PCBs, and grain-size distribution. The actual monitoring program would be designed during the remedial design phase of the project. The monitoring program would be reviewed and optimized based on the survey and analytical results. For cost-estimating purposes, the monitoring activities are assumed to be performed every 5 years for the assumed 30-year period, with results reported in conjunction with 5-year review reports.

If predesign investigation results for cadmium efflux analysis indicate potential risk, then additional cadmium efflux sampling will be performed as part of the post-remediation monitoring program.

6.5.1.5 REVIEWS AND REPORTING

For Alternative 4, it is assumed that the activities and findings of the predesign investigation would be summarized in the remedial design documentation. For the purposes of this FS Report, it is assumed that five 5-year reviews would be prepared pursuant to CERCLA Section 121 and the NCP requirements. A closeout report would be prepared in year 30. Reviews would be documented in summary reports issued to appropriate regulatory agencies.

6.5.2 Evaluation by Criteria

Evaluation of Alternative 4 using NCP threshold criteria and balancing criteria follows. The evaluation relative to the balancing criteria is summarized in Table 6-1. A cost estimate summary is presented in Table 6-4. The NCP modifying criteria are discussed in Section 7.

6.5.2.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternative 4 is considered protective of human health and the environment. The thin-layer cap is expected to prevent unacceptable ecological exposure to sediment in the AOEC. ICs are expected to protect the cap and prevent disturbance of underlying sediments. The assumed duration of ICs for Alternative 4 is 30 years. ICs would remain in place until RAOs were achieved and the Navy and regulatory agencies agreed that the site no longer posed potentially unacceptable ecological risk. Sediment monitoring would track the overall performance of the remedy and provide information to support future remedial action decisions.

6.5.2.2 COMPLIANCE WITH ARARs

Alternative 4 is expected to meet potential chemical-specific, location-specific, and action-specific ARARs. Potential ARARs associated with sampling waste, management of IDW, and ICs are the same as those identified for Alternative 3 (Section 6.4.2.2).

Substantive provisions of the *Clean Water Act* associated with placement of dredged or fill materials into waters of the United States were identified as potentially applicable ARARs for cap placement. Potential ARARs associated with this alternative have been identified and evaluated in Appendix A.

6.5.2.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

Alternative 4 is expected to be an effective means to prevent unacceptable ecological exposure to COCs in sediment. Thin-layer capping and ICs are expected to be reliable in minimizing potential future ecological risks associated with COCs in sediment in the AOEC.

ICs would be implemented to prohibit disturbance and dispersion of the cap and impacted sediment under the wharf road. Periodic inspections would be conducted as part of a performance monitoring program to maintain the integrity of the remedial action. Thin-layer capping and ICs are expected to be reliable in minimizing future potential ecological risks associated with COCs in sediment.

No significant cap maintenance is expected to be necessary after installation of the thin-layer cap because the cap area is not subject to significant tidal or wave action, propeller scour, or other forces that would be detrimental to the cap. Sediment monitoring and periodic reviews would be performed to confirm the protectiveness of the cap over time. The long-term effectiveness of ICs would depend on continued adherence to them. Alternative 4 assumes that ICs would be implemented for 30 years. However, once sediment monitoring results indicated that RAOs were achieved and that ICs were no longer warranted, the regulatory agencies and the Navy would determine if the ICs and monitoring program could be discontinued for Alternative 4.

6.5.2.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

Alternative 4 would not reduce toxicity, mobility or volume through active treatment. However, the mobility of COCs in sediment would be reduced by placement of the cap and, with time, through subsequent sedimentation and passive natural recovery processes. The thin-layer cap included in Alternative 4 would be expected to prevent unacceptable ecological exposure. Sediment sampling and analysis would provide information to evaluate cap performance and the rate of reduction in COC concentrations.

6.5.2.5 SHORT-TERM EFFECTIVENESS

Alternative 4 is considered effective in the short term. Alternative 4 would involve placement of clean sand over impacted sediment at IR Site 24. This operation is expected to require approximately 2.5 months for completion. Once in place, the cap would be expected to effectively prevent unacceptable ecological exposure to underlying impacted sediment. In addition, ICs could be put in place quickly at the site to prevent unacceptable exposure to COCs in sediment.

The thin-layer cap and ICs would achieve protection in a short period of time. Sediment in the AOEC would be permanently covered with clean sand, temporarily impacting benthic habitat in the AOEC. Approximately 50 truckloads of clean sand would be transported to the site. An additional five truck trips would be required for removal and disposal of debris.

For this alternative, the benthic habitat in the AOEC would be destroyed when the cap is placed. This habitat would experience a significant short-term impact; however, it would be expected to be reestablished in the granular cap material fairly quickly. Surface-water monitoring for turbidity would be performed during cap placement to ensure that capping operations did not disperse suspended sediment from the AOEC into the open-water area. Implementation of this alternative would not be expected to have other adverse effects on the environment, site workers, or the surrounding community.

6.5.2.6 IMPLEMENTABILITY

Alternative 4 would be moderately implementable because of the limited access and small work areas under the wharf road. Installation of thin-layer caps has been performed previously at other sites throughout the United States. Clean cap material is readily available in the San Francisco Bay Area. Sediment sampling and analysis can be performed at the site as demonstrated by previous investigations. Periodic sediment monitoring activities should not be incompatible with the potential reuse options; however, access to the area beneath the wharf road would need to be maintained to allow for monitoring. Additionally, ICs would be easily implementable at the site.

6.5.2.7 COST

The present-value cost for Alternative 4 is approximately $2,047,000 (Table 6-4). Major cost components for this alternative are associated with the cap placement, ICs, and sediment monitoring. For cost-estimating purposes, it is assumed that the duration of this alternative is 30 years. Appendix B provides cost backup and supporting details.

6.6 ALTERNATIVE 5 – SEDIMENT REMOVAL/DREDGING

Alternative 5 is a removal option that would employ dredging or a similar technology to remove sediment with COC concentrations exceeding preliminary RGs in the AOEC. The removed sediment would be disposed in an off-site commercial or hazardous waste landfill. Removal of impacted sediment would be verified through confirmation sampling. After completion of sediment removal, no ICs or long-term O&M activities would be required.

6.6.1 Description of Alternative

Alternative 5 involves dredging or a similar technology, and off-site disposal of impacted sediment. The extent of COCs in sediment exceeding preliminary RGs would be assessed during the predesign investigation included as part of this alternative. This alternative would permanently remove the contaminant mass from the AOEC to prevent future contact or exposure of ecological receptors to contaminants. The assumed total duration of Alternative 5 is 1 year.

Alternative 5 assumes that dredging or other sediment removal techniques would effectively remove the contaminated sediment from the AOEC. This alternative is included based on the following assumptions regarding the sediment removal process.

- The area subject to sediment removal is limited to the AOEC, as identified on Figure 6-3.
- Methods described in this section are for cost-estimating purposes only. Specific field methods will be described in remedial design documents. Other sediment removal methods such as diver-assisted hydraulic dredging may also be considered.
- Because access under the wharf road is limited, a combination of sediment removal techniques may be required, such as conventional dredging equipment (e.g., Aquamog or similar equipment), diver-assisted hydraulic dredging, and/or other sediment removal methods.

Alternative 5 includes the following components:

- a predesign investigation
- sediment removal/dredging
- off-site disposal
- confirmation sampling
- reporting

6.6.1.1 PREDESIGN INVESTIGATION

The predesign investigation for Alternative 5 would be identical to the investigation described for Alternative 4 (Figure 6-1), except that two sediment samples (shallow and deep) would be collected from each of the 40 sampling locations to further assess the vertical extent of the impacted sediment before sediment removal. The predesign investigation would be conducted either prior to the design or as the first step in the remediation.

6.6.1.2 SEDIMENT REMOVAL

Based on the RI results, COC concentrations in sediment exceeding preliminary RGs were reported at bottom depths ranging from 2 to 20 inches (5 to 50 cm) below the sediment surface. Because absolute precision is difficult to achieve in subaqueous sediment removal, Alternative 5 assumes sediment removal at 1-foot intervals, with depths ranging from 1 to 2 feet (30 to 60 cm) below the sediment surface. To minimize the volume of sediment to be dredged (and still accomplish the mass removal desired for this alternative), the 18,000-square-foot AOEC was divided into four subareas with varying depths. The proposed boundaries of the subareas were determined based on interpretation of COC concentrations reported for the sediment samples and the locations of the concrete/wooden pilings beneath the wharf road. During a site visit, the pilings were observed to be approximately 13 feet apart along the direction of the wharf road. Based on the proposed sediment removal areas and depths, the volume of impacted sediment is 1,000 bcy, as described in Section 3.5. With an over-dredge allowance of approximately 500 bcy, the estimated total volume of dredged sediment for FS purposes is 1,500 bcy. The final boundaries and depths of the sediment removal areas would be determined during the remedial design phase, based on interpretation of analytical results from the predesign investigation.

Mechanical dredging, hydraulic dredging, excavation, or a combination of these technologies could be used to remove sediment from the AOEC. Because of the limited access and work space under the wharf road, it is expected that fender piles along the quay wall would need to be removed to allow access. Sediment removal is assumed to be performed with small barge-mounted or pontoon-mounted mechanical dredging equipment west of the quay wall. East of the quay wall, a combination of sediment removal methods may be required, such as mechanical and hydraulic dredging and diver-assisted methods. Because of the small equipment, limited access, and tides, it is assumed that sediment removal would be a time-intensive process. Final selection of the sediment removal methods and equipment would take place during the remedial design phase. To reduce the transport of resuspended sediment released during sediment removal operations, physical containment barriers such as silt curtains or screens would be used as necessary. Surface-water monitoring for turbidity would be performed to ensure that sediment removal operations did not disperse resuspended sediment from the AOEC into the open-water area. During the sediment removal operations, driftwood, trash, clothing, and other debris would be removed; however, large debris such as concrete rubble and riprap would be left in place.

Alternative 5 assumes that dredged sediment and debris would be placed on a barge moored along the quay wall in the vicinity of the AOEC, and allowed to dewater. Due to typical restrictions on liquids in landfills, the dredged material might have to be dewatered further on land before offsite transport and disposal. After the sediment and debris were sufficiently dewatered to be nonflowing, they would be transferred from the barge to temporary staging piles on land to allow further dewatering by evaporation near the AOEC. To prevent unauthorized entry, a fence with signs would be installed around the area containing the staging piles (Figure 6-3). For FS purposes, it is assumed that the temporary staging piles would be constructed with lined perimeter barriers and bottom with a leachate collection system. Dredged material would be placed in thin layers, and mixing would be performed as needed to spread the wet dredged materials and accelerate evaporation. The sediment generally would not be completely dried, to prevent off-site migration of airborne particles, but would be dried sufficiently to pass the paint filter test (U.S. EPA Method 9095B) required by receiving landfills. The final location and construction details of the temporary staging piles would be determined during the remedial design phase.

After a first pass of sediment removal to the desired depth had been completed, confirmation samples would be collected from the new sediment surface and submitted to an off-site analytical laboratory for analysis of COCs (metals, pesticides, and PCBs). Analytical results would be reviewed to confirm whether COCs in remaining sediment exceeded preliminary RGs. For FS purposes, it is assumed that only one mobilization would be required and that one round of confirmation sampling would be conducted under this alternative.

After sediment removal and confirmation sampling activities had been completed, clean, washed granular backfill material (sand or gravel) from an off-site source would be placed in the dredged area to maintain the stability of the pier and wharf road structures in the AOEC. Two bathymetric surveys would be performed: a survey before backfilling operations and a final survey after completion of backfilling operations.

Detailed design documents would be prepared during the remedial design phase (after the issuance of the final ROD). In addition to determining the final boundaries of the AOEC and selection of the sediment removal method, the design might incorporate information on the construction and stability of the structures (e.g., wharf road, quay wall, piers, foundations, and pilings) in and near the proposed sediment removal area. The design of additional supports to preserve structural stability of the wharf road during sediment removal operations, if required, would be considered in the detailed design stage. Portions of the quay wall and water pipelines in the vicinity of the AOEC would likely need to be removed temporarily to allow access for sediment removal/dredging equipment and a barge for storing removed sediment. Details of these activities would also be described in the design documents.

6.6.1.3 OFF-SITE DISPOSAL

Dewatered sediment would be segregated, stockpiled, and characterized before off-site disposal. For FS purposes, it is assumed that 50 percent of the dredged volume would be managed as Class II nonhazardous waste, 25 percent would be classified as RCRA hazardous waste due to metal concentrations and would require stabilization to meet RCRA land-disposal restrictions, and 25 percent would be classified as California hazardous waste. These percentages were based on an evaluation of the concentrations of COCs in sediment in the AOEC. These percentages are assumptions based on existing data, and were used to estimate the off-site disposal costs of the dredged sediments. Actual percentages and volumes of dredged sediments classified as nonhazardous or hazardous waste will be determined after reviewing the analytical results of waste profile samples before off-site disposal. It is assumed that the debris would be classified as nonhazardous waste.

Wet sediment placed on the barge would be allowed to drain until the sediment was considered nonflowing, with water shunted back into the AOEC. Following this initial dewatering, the sediment from the barge would be transferred to temporary staging piles on land near the AOEC and allowed to further dewater. Water from land-side dewatering is assumed to be minimal. The water would be allowed to evaporate, or would be collected into drums or a small aboveground storage tank and characterized before off-site disposal. It is assumed that any water collected from the staging piles would be classified as nonhazardous waste. Final disposition of water would be determined during the remedial design stage.

6.6.1.4 CONFIRMATION SAMPLING

After sediment removal had been completed in a given sub-area, confirmation samples would be collected and submitted to an off-site analytical laboratory for analysis of COCs. Analytical results would be reviewed to confirm that impacted sediment with COC concentrations exceeding preliminary RGs had been removed from the AOEC. For FS purposes, it is assumed that only one round of confirmation sampling would be conducted under this alternative. The final confirmation sampling and analysis program would be developed during the remedial design stage.

Confirmation samples would be collected by sub-area within the AOEC as sediment removal progresses. Due to the high number of obstructions associated with the area under the wharf road, some sediment with concentrations of COCs exceeding preliminary RGs is likely to remain after sediment removal has been completed (e.g., behind piles). Potential residual contamination after sediment removal is likely to be absorbed into the beneficial change in the exposure point concentration across the AOEC. Therefore, even if it were not feasible to remove some impacted sediment associated with the obstructions within the AOEC under the wharf road, the overall exposure after dredging would be reduced to an acceptable level.

6.6.1.5 REVIEWS AND REPORTING

For Alternative 5, it is assumed that the activities and findings of the predesign investigation would be summarized in the remedial design documentation. A remedial action closeout report would be prepared following the completion of the remediation activities. A 5-year review pursuant to CERCLA Section 121 and the NCP is required if the selected remedy allows contaminants to remain at the site above levels that would allow for unrestricted use of the site. Because the assumed total duration of this alternative is less than 5 years, a 5-year review is not included. However, the Navy would conduct a 5-year review for this site if the selected remedy was not completed within this time period.

6.6.2 Evaluation by Criteria

Evaluation of Alternative 5 using NCP threshold and balancing criteria follows. The evaluation relative to the balancing criteria is summarized in Table 6-1. A cost estimate summary is presented in Table 6-5. The NCP modifying criteria are discussed in Section 7.

6.6.2.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Alternative 5 would be protective of human health and the environment. Under this alternative, all impacted sediment exceeding preliminary RGs would be removed from the AOEC at IR Site 24. Dredged sediment would be disposed at an off-site disposal facility. Any treatment required in order to meet land-disposal restrictions would be performed at the disposal facility prior to land disposal. Potentially unacceptable ecological exposure to contaminants in the AOEC would be eliminated under this alternative.

6.6.2.2 COMPLIANCE WITH ARARs

Alternative 5 is expected to meet potential chemical-specific, location-specific, and action-specific ARARs. Potential ARARs for this alternative have been evaluated and identified in Appendix A. Potential ARARs associated with sampling, management of IDW, and ICs are the same as those identified for Alternative 3 (Section 6.4.2.2).

Potential ARARs associated with the placement of fill into waters of the United States described for Alternative 4 (Section 6.5.2.2) would apply to this alternative. However, because no discharge of dredge material to waters is proposed, these potential *Clean Water Act* ARARs would only apply to fill placement activities.

Staging-pile requirements under RCRA were identified as potentially applicable ARARs for Alternative 5 for RCRA waste. If dredged sediment is not hazardous but is similar to hazardous waste, these requirements are potentially relevant and appropriate.

6.6.2.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

Alternative 5 is considered to be an effective and permanent alternative over the long term, achieving removal of sediment containing COC concentrations exceeding preliminary RGs at the AOEC. Once the remedial action was completed, this alternative would eliminate unacceptable exposure to impacted sediment in the AOEC. No ICs or long-term O&M activities would be required under this alternative.

6.6.2.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

Because impacted sediment would be removed and disposed at an off-site disposal facility under Alternative 5, the mass of sediment containing COCs at concentrations exceeding preliminary RGs would be completely removed. Any treatment required to meet land-disposal restrictions would be performed at the disposal facility prior to disposal. This treatment would reduce the toxicity and mobility of chemicals in hazardous sediment prior to disposal. Dredged sediment would not be treated unless required to meet land-disposal restrictions.

6.6.2.5 SHORT-TERM EFFECTIVENESS

Under Alternative 5, approximately 65 truck trips through the community would be required for sediment disposal. An additional 70 truck trips would be required for disposal of debris and water and for importing backfill material. The sediment removal and off-site disposal operations are expected to take up to 3.5 months for completion. This alternative has the potential to track impacted sediment off-site during transport through the community en route to the disposal facility. However, potential risks would be mitigated through proper design and implementation of a site-specific safety and health plan and a remedial action work plan. These plans would include provisions for personnel protection and contingency actions needed to protect workers and the nearby community.

For this alternative, the benthic habitat in the AOEC would be destroyed during the removal of impacted sediment in the dredged area. This habitat would experience a significant short-term impact; however, it would be expected to be reestablished in the clean backfill sand fairly quickly. Other potential receptors in the overall aquatic environment would be displaced until the remedial action was completed, thus also experiencing a short-term impact. Dispersion of impacted sediment during sediment removal operations would be controlled with a silt curtain or screen around the area being dredged. Surface-water monitoring for turbidity would be performed to ensure that sediment removal operations did not disperse resuspended sediment from the AOEC into the open-water area.

6.6.2.6 IMPLEMENTABILITY

Alternative 5 would be moderately implementable because of the limited access and small work areas under the wharf road. Dredging beneath structures is usually performed with smaller equipment that would be expected to have a slower dredging rate than dredging operations in open-water areas. Transportation and off-site disposal of impacted media have been performed in the past at Alameda Point. Disposal facilities in the state of California are capable of accepting the anticipated volumes of dredged sediment and residual wastes. The schedule would need to minimize any disruption of current site activities and to consider that the rate of dewatering of dredged material would depend on weather conditions (i.e., the dewatering rate is faster during dry, warm months).

6.6.2.7 COST

The present-value cost for Alternative 5 is approximately $3,324,000 (Table 6-5). Major cost components for this alternative are associated with sediment removal, debris removal, sediment disposal, and sediment sampling. For cost-estimating purposes, it is assumed that this alternative would be completed in 1 year. Appendix B provides cost backup and supporting details.

Section 7
COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

The remedial alternatives evaluated in Section 6 provide a range of options for remediation of sediment in the AOEC at IR Site 24. These alternatives were developed after consideration of the requirements of the NCP, U.S. EPA technical guidance (U.S. EPA 1988), statutory preferences listed in CERCLA Section 121(b), and RAOs (Section 3).

Five alternatives were evaluated in detail in Section 6:

- **Alternative 1 – no action.** No further action of any type would be taken.
- **Alternative 2 – ICs.** ICs are assumed to be required indefinitely. For cost-estimating purposes, ICs would be implemented for an assumed duration of 30 years.
- **Alternative 3 – MNR with ICs.** The duration for the ICs is based on the results of the monitoring. For cost-estimating purposes, MNR would be performed in association with ICs for an assumed duration of 30 years. The MNR program and ICs would be put in place until the regulatory agencies and the Navy agreed that the MNR program and ICs were no longer warranted.
- **Alternative 4 – thin-layer capping with ICs.** A thin-layer cap would be installed over the remediation area where concentrations of COCs in sediment exceed preliminary RGs. A monitoring program and ICs would be put in place until the regulatory agencies and the Navy agreed that monitoring and ICs were no longer warranted. For cost-estimating purposes, the assumed duration for this alternative is 30 years.
- **Alternative 5 – sediment removal/dredging.** Dredging or a similar technology would be performed to remove sediment with COC concentrations exceeding preliminary RGs. No ICs or long-term O&M activities would be implemented for this alternative. The assumed duration for this alternative is 1 year.

This section compares the relative performance of the remedial alternatives considered in this FS Report against the NCP evaluation criteria described in Section 6.1. This comparative analysis considers the advantages and disadvantages of each alternative and identifies key trade-offs the Navy must consider when selecting a cleanup remedy.

CERCLA Section 121(d) and the NCP at 40 C.F.R. § 300.430(f)(1)(ii) require that a remedy must protect human health and the environment and comply with ARARs, unless justification to waive a specific ARAR is provided in the ROD. Both NCP threshold criteria must be satisfied for a remedial alternative to be eligible for selection, unless an ARARs waiver applies. Therefore, the selection of eligible remedial alternatives will generally be based on a comparison of the alternatives with respect to satisfying the five NCP balancing criteria and the two NCP modifying criteria. The subsections below compare the remedial alternatives with respect to meeting the NCP threshold criteria and balancing criteria. As suggested by U.S. EPA (1988), the alternative(s) that perform best under each of the balancing criteria are discussed first, with other alternatives discussed in the relative order in which they perform.

The two NCP modifying criteria (state acceptance and community acceptance) are also briefly addressed in this section. The Navy will present a more extensive evaluation of the alternatives relative to the modifying criteria in the ROD after formal comments have been received on the PP, and a final remedy selection decision is being made.

This section presents a comparative analysis of the sediment remedial alternatives analyzed in Section 6 of this FS Report. This information and the detailed analysis of the alternatives by balancing criteria are presented in Table 6-1. Alternatives are rated "high," "medium," or "low," based on their performance under each criterion. For example, an alternative that is substantially easier to implement than other alternatives is rated high in implementability. Similarly, an alternative that would be significantly lower in cost than the other alternatives is rated high because it would perform most favorably under the cost criterion. The alternatives are ranked based on their overall protectiveness to ecological receptors and on their ability to meet the RAOs discussed in Section 3. Additional discussion of anticipated future land uses is also presented.

7.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

The RI Report concluded that there are no current complete human-health exposure pathways at the site, but the sediment shelf in the vicinity of the quay wall and beneath the wharf road between Piers 1 and 2 presents a potentially unacceptable risk to ecological receptors (Battelle et al. 2007). There are no plans to demolish or remove the piers at IR Site 24, and it has been proposed that future site use would consist of docking large-scale ships such as ferries, cruise ships, or historical landmark vessels (EDAW 1996). Under Alternative 1, impacted sediment would be left in place without any mitigation, treatment, or monitoring; therefore, potentially unacceptable risks to ecological receptors would remain. For these reasons, Alternative 1 is not considered protective of human health and the environment. Because Alternative 1 does not meet the threshold criterion of overall protection of human health and the environment, an evaluation against the primary balancing and modifying criteria is not necessary and was not performed. Alternatives 2 through 5 meet the threshold criterion of overall protection of human health and the environment through the implementation of ICs, capping, or removal of sediment with COCs that might pose unacceptable ecological risk. EPA does not concur that Alternative 2 meets the threshold protectiveness criterion.

7.2 COMPLIANCE WITH ARARs

Potential chemical- and location-specific ARARs were discussed in Section 3.3. Potential action-specific ARARs for each alternative were described in Section 6. Alternatives 1 through 5 meet the threshold criterion of compliance with ARARs.

7.3 LONG-TERM EFFECTIVENESS AND PERMANENCE

Alternative 5 is rated high in long-term effectiveness and permanence. It is considered the most effective and permanent of the alternatives evaluated. It would permanently remove sediment with COC concentrations exceeding preliminary RGs. Once the remedial action was completed, this alternative would eliminate unacceptable exposure to impacted sediment.

Alternative 4 is rated medium in long-term effectiveness and permanence. It would require long-term sediment monitoring and periodic reviews to confirm the protectiveness of the thin-layer cap over time. The long-term effectiveness of the ICs included in this alternative would depend on continued adherence to them.

Alternative 2 is rated low in long-term effectiveness and permanence because the effectiveness of natural recovery processes would not be verified and sediment concentrations would not be monitored. Alternative 3 is also rated low under this criterion because it would require long-term sediment monitoring and periodic reviews to evaluate the progress of MNR in reducing ecological risk. The long-term effectiveness of the ICs included in these alternatives would depend on continued adherence to them.

7.4 REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT

Alternative 5 would be the most effective alternative in reducing the toxicity, mobility, or volume of COCs through treatment, and is rated medium under this criterion. Alternative 5 would involve removal of all dredged sediment and transportation to an appropriate off-site waste disposal facility. Any treatment required to meet RCRA land disposal restrictions would be performed at the disposal facility prior to disposal.

Alternatives 2, 3, and 4 would not reduce toxicity, mobility, or volume through treatment, and are therefore rated low under this criterion. For these alternatives, the toxicity, mobility, or volume of COCs in sediment would be reduced with time through passive natural processes; no active treatment would be provided. However, the thin-layer cap included in Alternative 4 would be expected to reduce the mobility of the impacted sediment.

7.5 SHORT-TERM EFFECTIVENESS

Alternative 4 is rated high in short-term effectiveness because the thin-layer cap and ICs would achieve protectiveness in a short amount of time, and would have slightly lower short-term impacts to the community than Alternative 5. Placement of the thin-layer cap is expected to take approximately 5 months for completion following approval of remedial design documents. For Alternative 4, the benthic habitat in the AOEC would be covered with sand when the cap is placed. However, it would be expected to be reestablished in the granular cap material fairly quickly.

Alternatives 3 and 5 are rated medium in short-term effectiveness. Time until protection is achieved under Alternative 3 is expected to be longer than Alternative 5, but Alternative 3 would pose no short-term risks to the community and would have minimal impact to the benthic habitat.

Under Alternative 5, removal of impacted sediment is expected to take up to 6 months for completion following approval of remedial design documents, so the time until protection is achieved would be short. Alternative 5 would involve more short-term impacts during implementation than Alternatives 3 and 4, because it would involve dredging (or a similar technology) and transporting impacted sediment through the community en route to the approved disposal facility. The benthic community in the AOEC would be destroyed by this alternative, but would be expected to be reestablished in the clean backfill sand fairly quickly.

Alternative 2 is rated low for short-term effectiveness. Because this alternative does not include monitoring, the time until protection is achieved would not be known.

7.6 IMPLEMENTABILITY

Alternatives 2 and 3 are rated high in implementability because these alternatives involve very limited action. Implementation of ICs and sediment sampling activities has been performed in the past at Alameda Point and can be easily accomplished. Alternatives 4 and 5 are rated medium in implementability because they involve the design and implementation of remediation processes in small work areas with limited access between piers underneath the wharf road.

7.7 COST

The estimated costs for the remedial alternatives are summarized in Table 7-1. Cost estimates are presented solely for the purpose of comparing alternatives in this FS Report; they should not be used for budgetary or planning purposes because actual costs may change based on the final design and the length of time until RAOs are met.

Alternative 2 is rated high under the cost criterion, as the net present value cost for this alternative is the lowest of all in cost, at less than $1 million. Alternative 3 is rated medium, with a net present value between $1 million and $2 million. Alternatives 4 and 5 are rated low under the cost criterion, as the net present-value costs for these alternatives are both above $2 million.

7.8 STATE ACCEPTANCE

This criterion evaluates remedial alternatives with respect to meeting the concerns of state regulatory agencies. Responses to the state's comments on the draft FS Report are included in Appendix C. Agency comments on the draft FS Report have been addressed and included in the draft final FS Report. State comments will also be considered in finalizing the Proposed Plan and ROD.

7.9 COMMUNITY ACCEPTANCE

This criterion assesses issues of concern to the community for each remedial alternative. Comments on the draft FS Report were solicited from the RAB in November 2007; no comments were received. Any comments received from community members during the public review period for the PP will be considered in the remedy-selection process. A summary of public comments and responses will be included in the ROD.

7.10 CONCLUSIONS

Alternatives 2, 3, 4, and 5 meet the threshold criteria for current and anticipated future land uses of IR Site 24. Alternative 1 does not meet the threshold criteria for current and anticipated future land uses of IR Site 24.

Alternative 5 is rated highest overall in satisfying the balancing criteria. Alternatives 2, 3, and 4 are rated lower than Alternative 5 in satisfying the balancing criteria.

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Section 8
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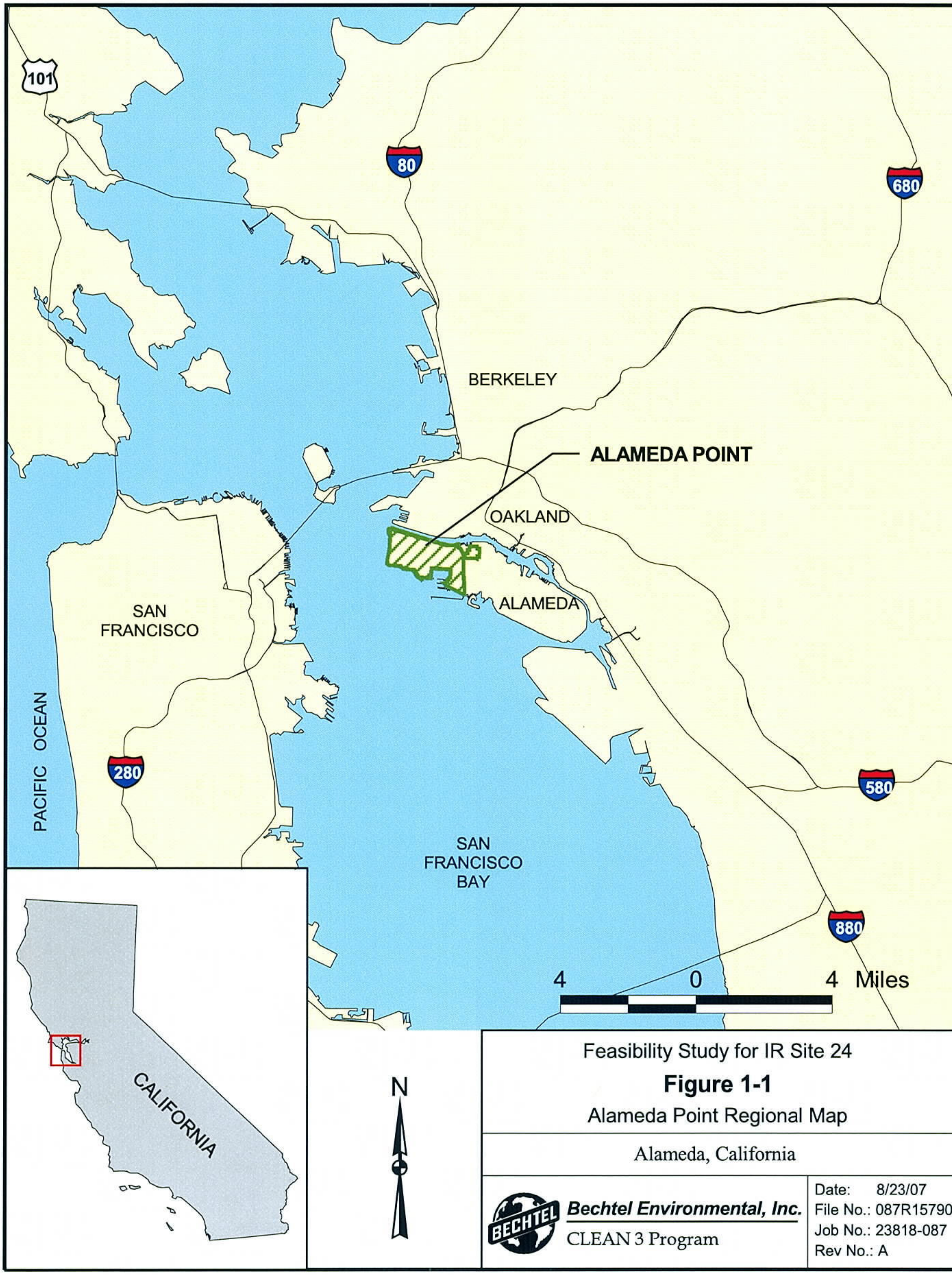
FIGURES



Feasibility Study for IR Site 24

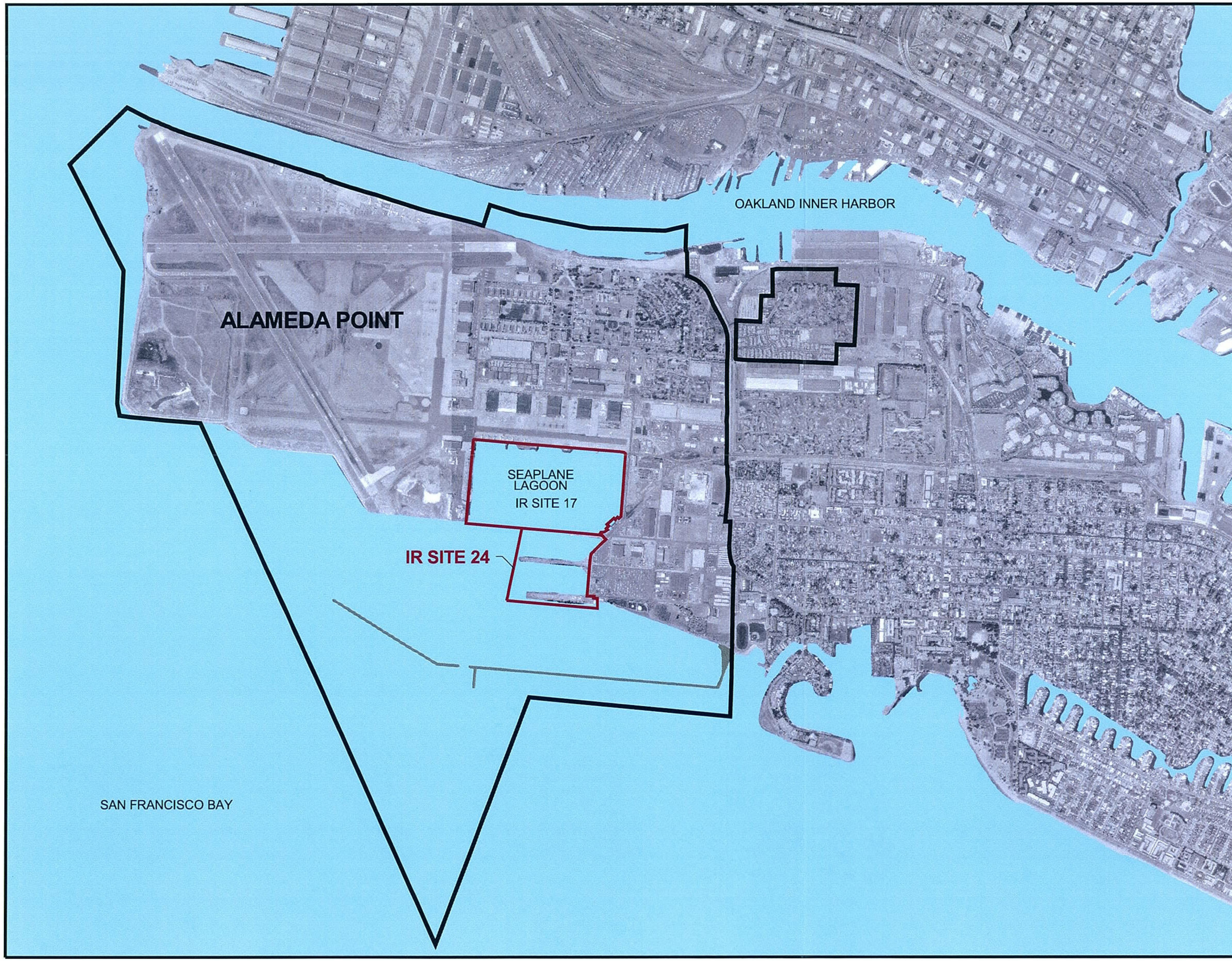
Figure 1-1

Alameda Point Regional Map

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 8/23/07
File No.: 087R15790
Job No.: 23818-087
Rev No.: A



Feasibility Study for IR Site 24

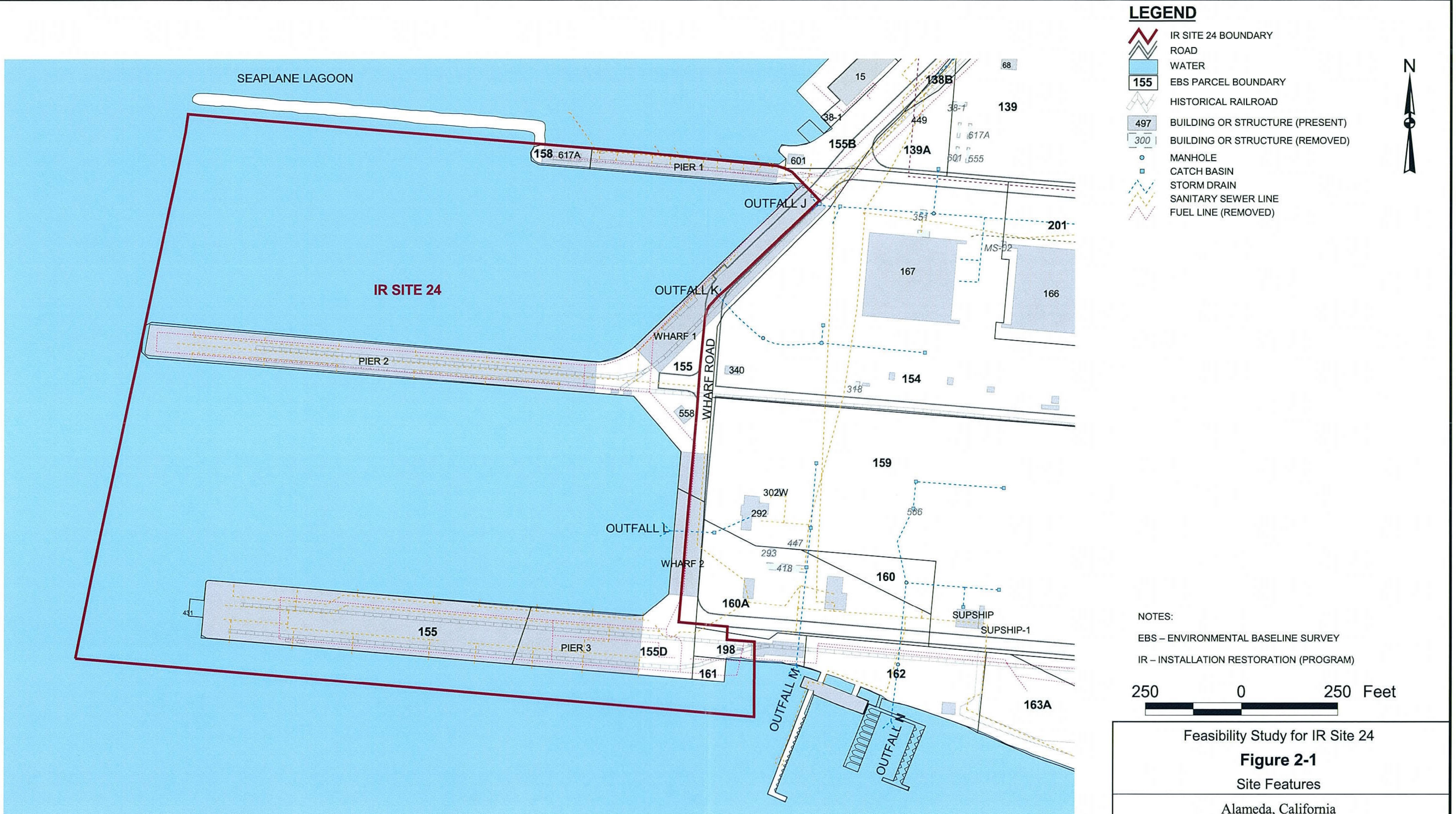
Figure 1-2

Site Location Map

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 11/7/07
File No.: 087L15791
Job No.: 23818-087
Rev No.: D



Feasibility Study for IR Site 24

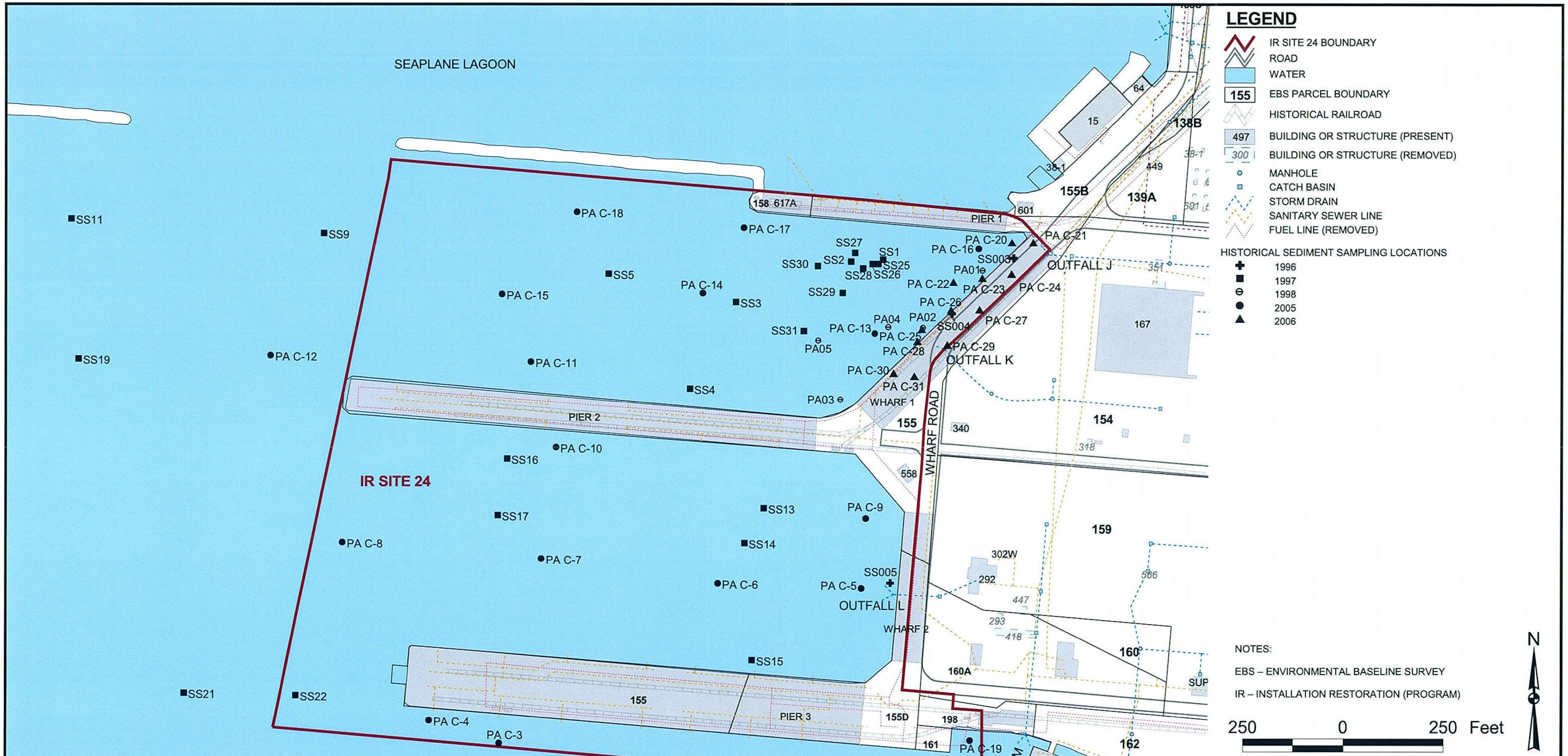
Figure 2-1

Site Features

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 3/24/08
File No.: 087L15792
Job No.: 23818-087
Rev No.: E



Feasibility Study for IR Site 24

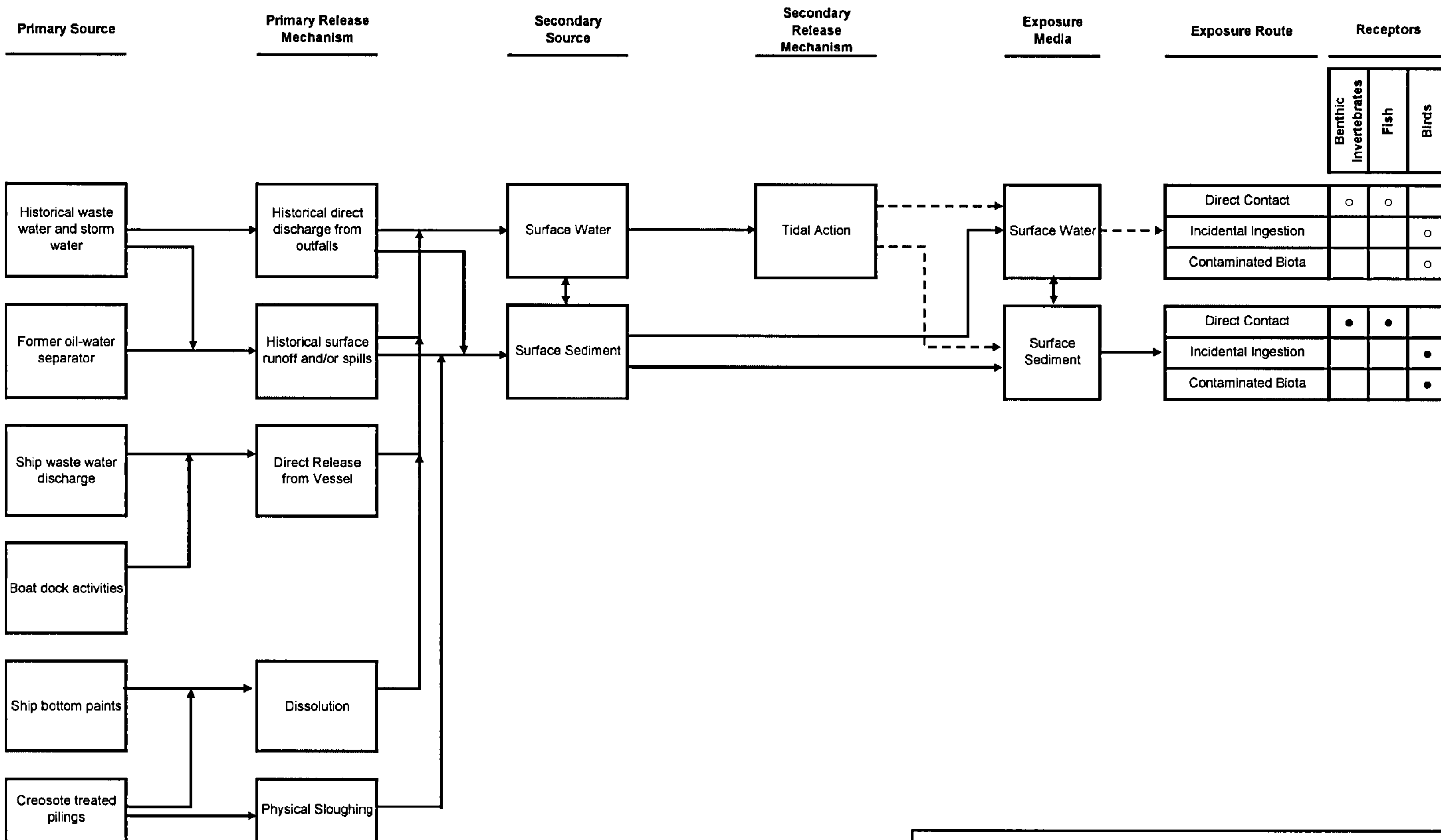
Figure 2-2

Sediment Sampling Locations

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 3/24/08
File No.: 087L15793
Job No.: 23818-087
Rev No.: D



Explanation:

- ○ Potentially complete exposure pathway, but exposure is insignificant.
- ● Potentially complete exposure pathway, evaluated quantitatively.
- ⟶ Major exposure pathway
- - - ➝ Minor exposure pathway

Note: Incomplete exposure pathway is indicated by a blank receptor cell.

SOURCE:

Battelle, Arcadis BBL, and Neptune and Company. 2007. Final Remedial Report for IR Site 20 (Oakland Inner Harbor) and IR Site 24 (Pier Area), Alameda Point, Alameda, California. June.

Feasibility Study for IR Site 24

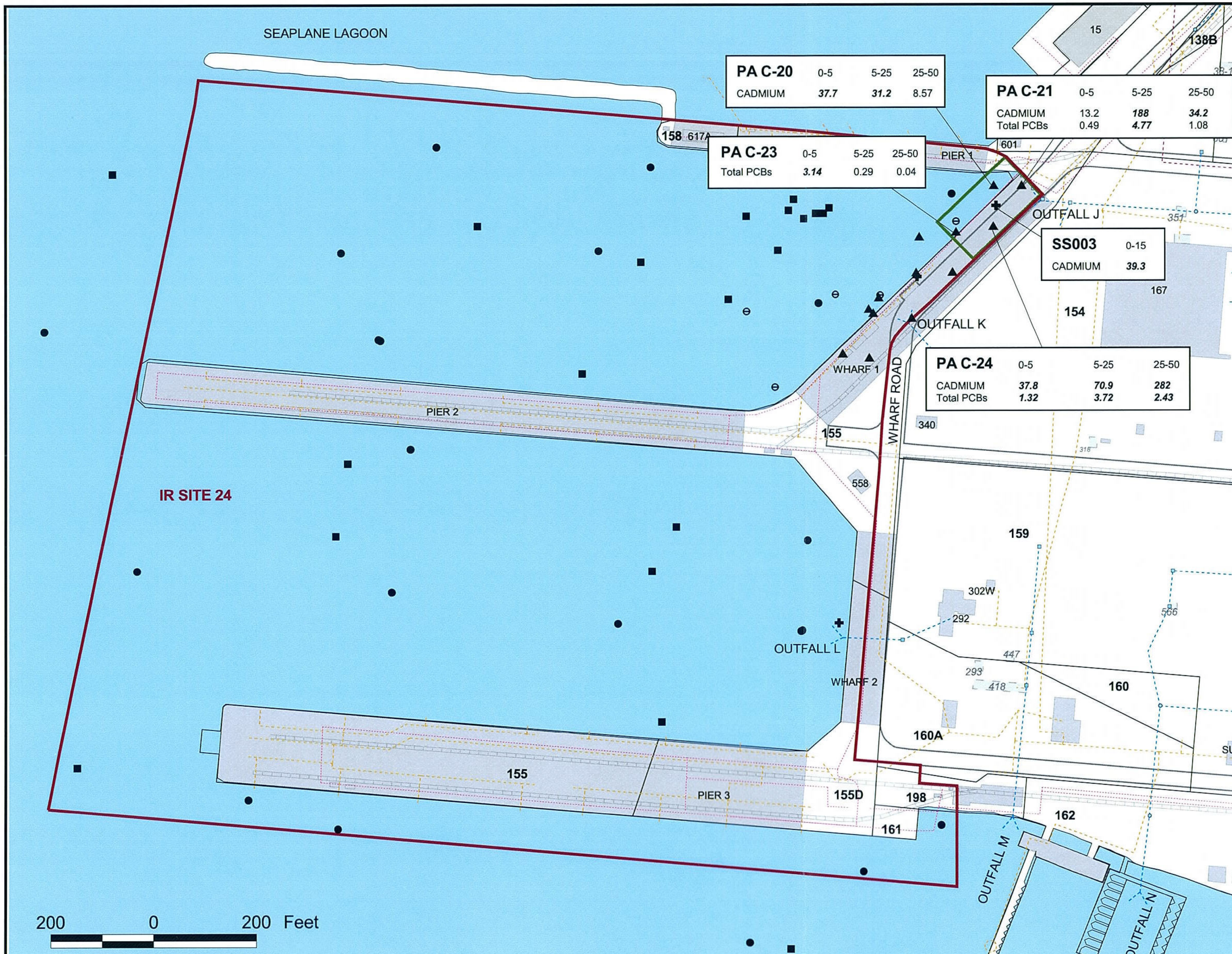
Figure 2-3

Ecological Conceptual Site Model

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 11/12/07
File No: 087C15787
Job No: 23818-087
Rev No: E



LEGEND

- IR SITE 24 BOUNDARY
- ROAD
- WATER
- 155 EBS PARCEL BOUNDARY
- HISTORICAL RAILROAD
- 497 BUILDING OR STRUCTURE (PRESENT)
- 300 BUILDING OR STRUCTURE (REMOVED)
- MANHOLE
- CATCH BASIN
- STORM DRAIN
- SANITARY SEWER LINE
- FUEL LINE (REMOVED)

HISTORICAL SEDIMENT SAMPLING LOCATIONS

- ✚ 1996
- ■ 1997
- ⊖ 1998
- ● 2005
- ▲ 2006
- AREA OF ECOLOGICAL CONCERN

STATION ID — SAMPLING INTERVAL IN CM BELOW SEDIMENT SURFACE

SS003	0-15
CADMIUM	39.3

ANALYTE — CONCENTRATION IN mg/kg

ANALYTE	PRELIMINARY REMEDIATION GOAL (mg/kg)
CADMIUM	24.4
Total PCBs	1.13
Total DDx	0.13

NOTES:

ALL UNITS ARE mg/kg. RESULTS ABOVE PRELIMINARY REMEDIATION GOALS ARE SHOWN IN ***BOLD ITALICS.***

RESULTS REPORTED FOR TOTAL DDx ARE BELOW PRELIMINARY REMEDIATION GOALS

RESULTS REPORTED FOR CADMIUM AND PCB COGENERS (USED TO CALCULATE TOTAL PCB VALUES) WERE TAKEN FROM BATTELLE et al. 2007.

CM – CENTIMETERS (1 CM = 0.0328 FOOT)
DDx - SUM OF THE PESTICIDES DDT [DICHLORODIPHENYLTRICHLOROETHANE], DDE [DICHLORODIPHENYLDICHLOROETHENE], AND DDD [DICHLORODIPHENYLDICHLOROETHANE]
EBS – ENVIRONMENTAL BASELINE SURVEY
IR – INSTALLATION RESTORATION (PROGRAM)
mg/kg – MILLIGRAMS PER KILOGRAM
PCB – POLYCHLORINATED BIPHENYL

Feasibility Study for IR Site 24

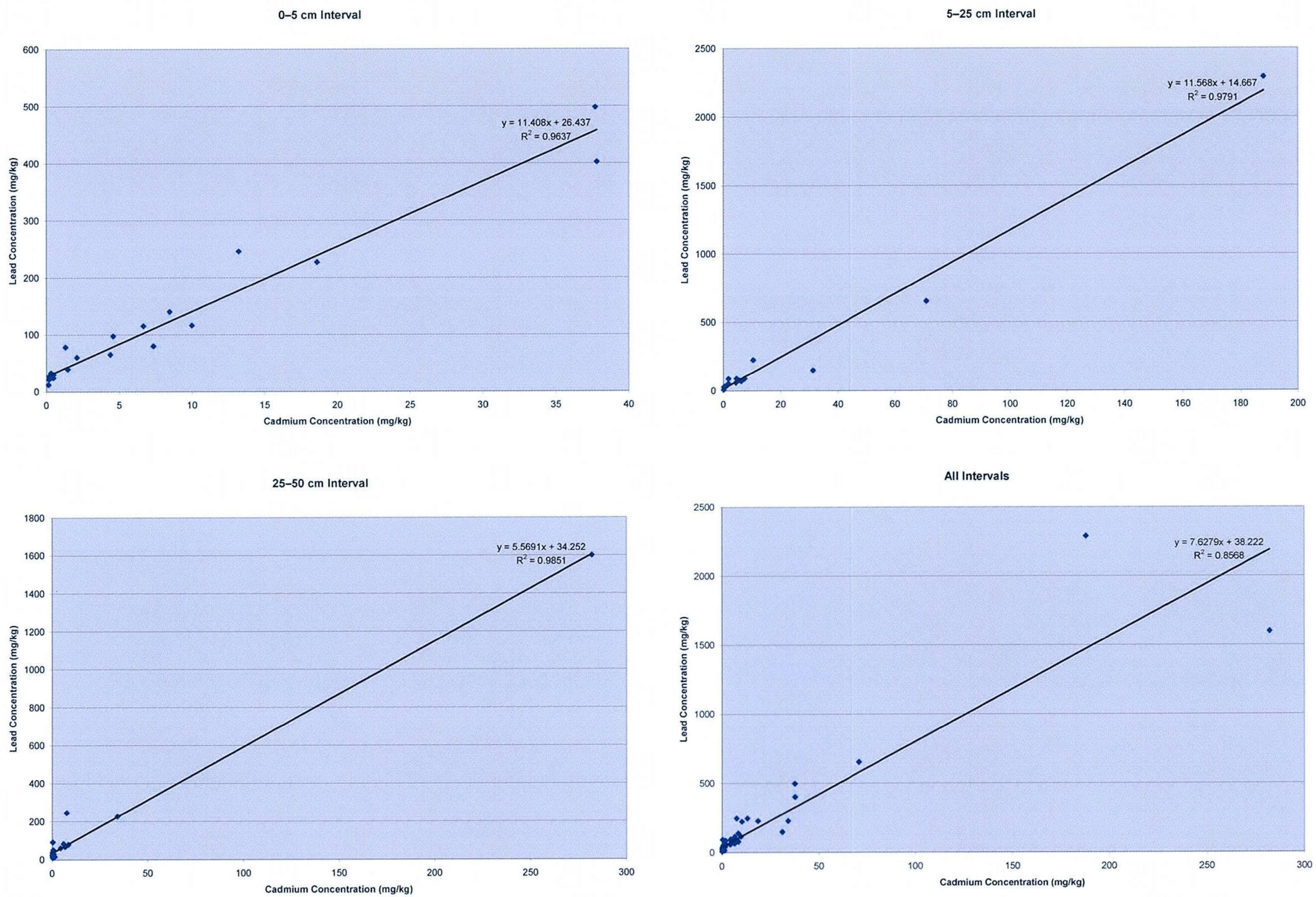
Figure 3-1

Area of Ecological Concern With Exceedances of Preliminary Remediation Goals

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 9/16/08
File No.: 087L15748
Job No.: 23818-087
Rev No.: H



NOTES:

◆ LEAD CONCENTRATION

LINEAR CORRELATION BETWEEN LEAD AND CADMIUM

cm CENTIMETERS (1 CM = 0.0328 FOOT)

mg/kg MILLIGRAMS PER KILOGRAM

Feasibility Study for IR Site 24

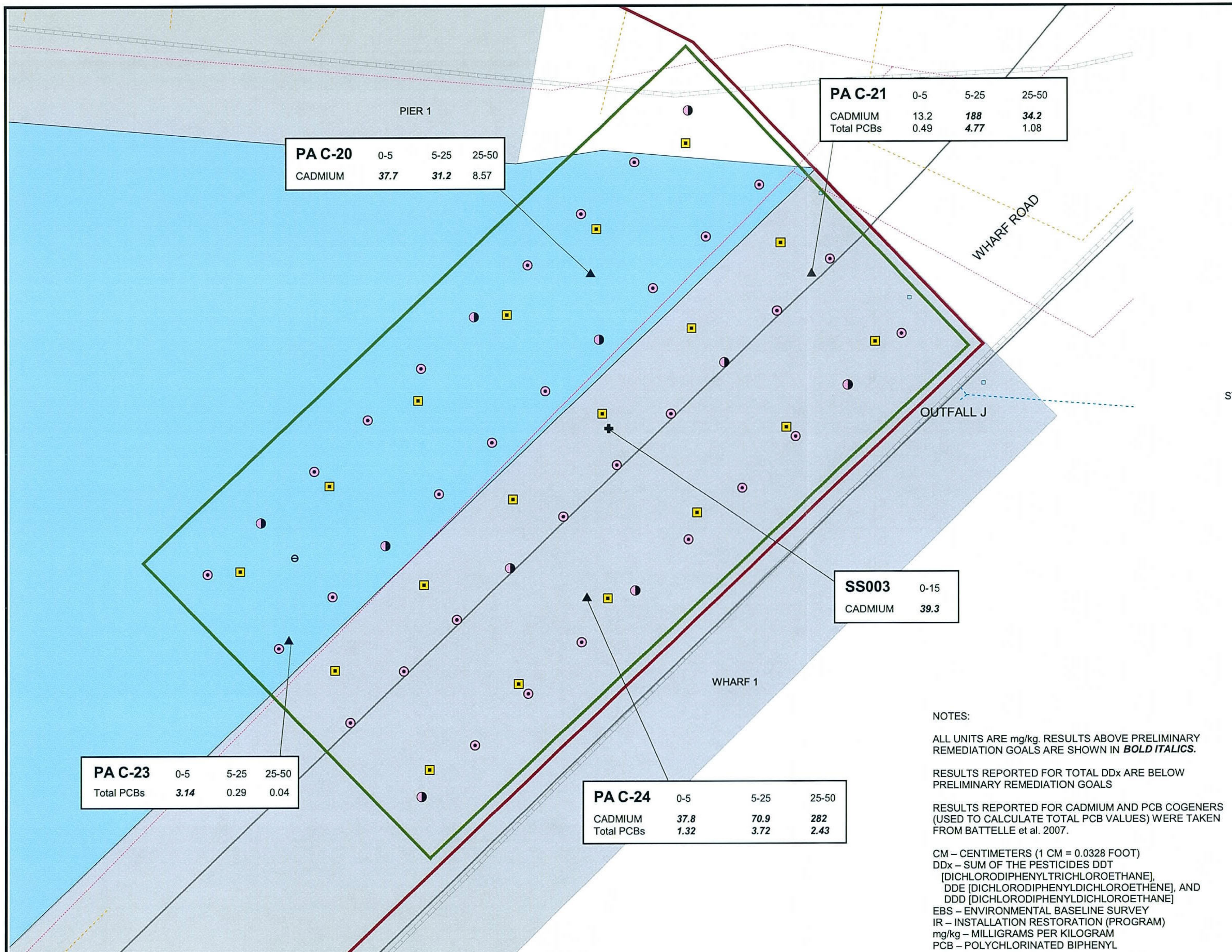
Figure 3-2

Correlation Between Lead and Cadmium

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 3/24/08
File No: 087C15890
Job No: 23818-087
Rev No: E



LEGEND

- IR SITE 24 BOUNDARY
- ROAD
- WATER
- HISTORICAL RAILROAD
- 497 BUILDING OR STRUCTURE (PRESENT)
- CATCH BASIN
- STORM DRAIN
- SANITARY SEWER LINE
- FUEL LINE (REMOVED)

HISTORICAL SEDIMENT SAMPLING LOCATIONS

- 1996
- 1997
- 1998
- 2005
- 2006
- AREA OF ECOLOGICAL CONCERN
- PROPOSED PERMANENT SAMPLING LOCATION FOR ALTERNATIVE 3
- PROPOSED PERMANENT SAMPLING LOCATION FOR ALTERNATIVES 4 AND 5
- PROPOSED TEMPORARY SAMPLING LOCATION FOR ALTERNATIVES 4 AND 5

STATION ID — SAMPLING INTERVAL IN CM BELOW SEDIMENT SURFACE

SS003	0-15
CADMIUM	39.3

ANALYTE — CONCENTRATION IN mg/kg

ANALYTE	PRELIMINARY REMEDIATION GOAL (mg/kg)
CADMIUM	24.4
Total PCBs	1.13
Total DDx	0.13

N

NOTES:

ALL UNITS ARE mg/kg. RESULTS ABOVE PRELIMINARY REMEDIATION GOALS ARE SHOWN IN ***BOLD ITALICS.***

RESULTS REPORTED FOR TOTAL DDx ARE BELOW PRELIMINARY REMEDIATION GOALS

RESULTS REPORTED FOR CADMIUM AND PCB COGENERS (USED TO CALCULATE TOTAL PCB VALUES) WERE TAKEN FROM BATTELLE et al. 2007.

CM – CENTIMETERS (1 CM = 0.0328 FOOT)
DDx – SUM OF THE PESTICIDES DDT [DICHLORODIPHENYLTRICHLOROETHANE], DDE [DICHLORODIPHENYLDICHLOROETHENE], AND DDD [DICHLORODIPHENYLDICHLOROETHANE]
EBS – ENVIRONMENTAL BASELINE SURVEY
IR – INSTALLATION RESTORATION (PROGRAM)
mg/kg – MILLIGRAMS PER KILOGRAM
PCB – POLYCHLORINATED BIPHENYL

25 0 25 Feet

Feasibility Study for IR Site 24

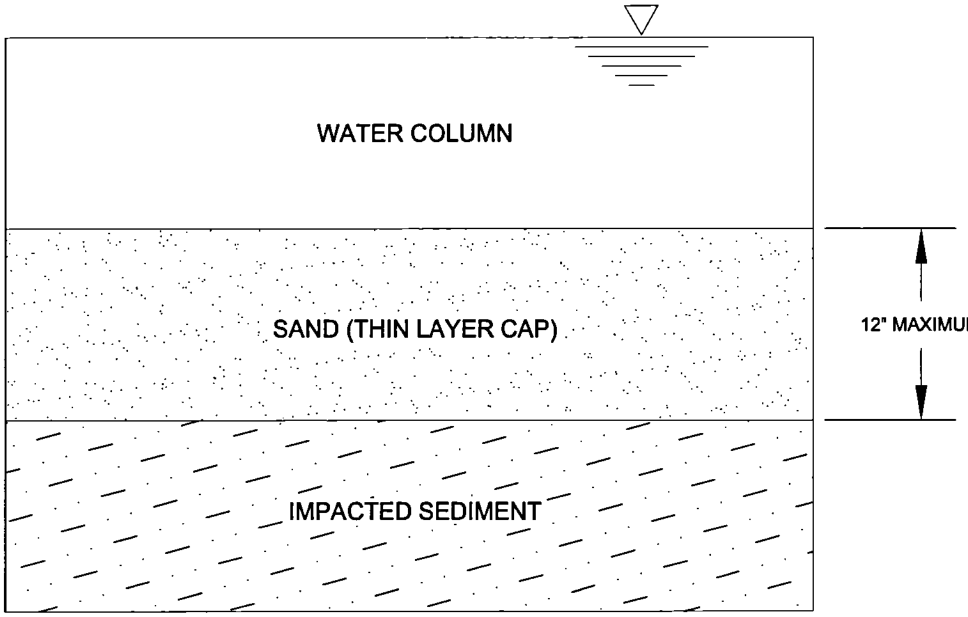
Figure 6-1

Area of Ecological Concern With Exceedances of Preliminary Remediation Goals and Proposed Sampling Locations

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 9/15/08
File No.: 087L15762
Job No.: 23818-087
Rev No.: G



NOTE:
IR – INSTALLATION RESTORATION (PROGRAM)

Feasibility Study for IR Site 24

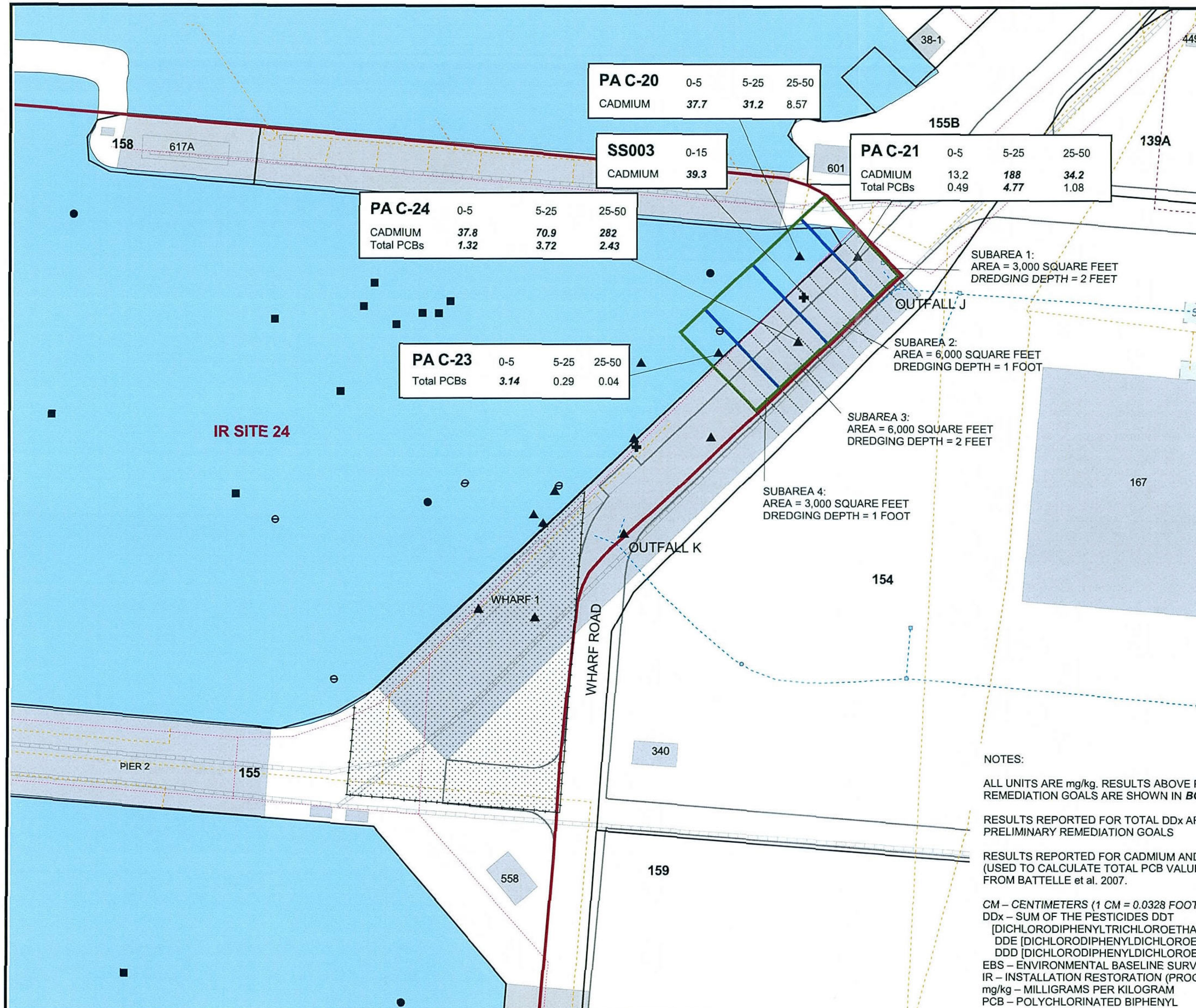
Figure 6-2

Conceptual Design for Alternative 4
Thin-Layer Cap

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 9/11/07
File No: 087C15763
Job No: 23818-087
Rev No: D



LEGEND

- IR SITE 24 BOUNDARY
- ROAD
- WATER
- 155 EBS PARCEL BOUNDARY
- HISTORICAL RAILROAD
- 497 BUILDING OR STRUCTURE (PRESENT)
- 300 BUILDING OR STRUCTURE (REMOVED)
- CONCRETE/WOODEN SUPPORT PILING (APPROXIMATE)
- MANHOLE
- CATCH BASIN
- STORM DRAIN
- SANITARY SEWER LINE
- FUEL LINE (REMOVED)

HISTORICAL SEDIMENT SAMPLING LOCATIONS
- 1996
- 1997
- 1998
- 2005
- 2006

- AREA OF ECOLOGICAL CONCERN
- SUBAREA BOUNDARIES
- *PROPOSED STAGING AREA FOR EQUIPMENT AND STAGING PILES*
- PROPOSED STAGING AREA FENCELINE

N

STATION ID — SAMPLING INTERVAL IN CM BELOW SEDIMENT SURFACE

SS003	0-15
CADMIUM	***39.3***

ANALYTE — CONCENTRATION IN mg/kg

ANALYTE	PRELIMINARY REMEDIATION GOAL (mg/kg)
CADMIUM	24.4
Total PCBs	1.13
Total DDx	0.13

100 0 100 Feet

NOTES:

ALL UNITS ARE mg/kg. RESULTS ABOVE PRELIMINARY REMEDIATION GOALS ARE SHOWN IN ***BOLD ITALICS.***

RESULTS REPORTED FOR TOTAL DDx ARE BELOW PRELIMINARY REMEDIATION GOALS

RESULTS REPORTED FOR CADMIUM AND PCB COGENERS (USED TO CALCULATE TOTAL PCB VALUES) WERE TAKEN FROM BATTELLE et al. 2007.

CM – CENTIMETERS (1 CM = 0.0328 FOOT)
DDx – SUM OF THE PESTICIDES DDT [DICHLORODIPHENYLTRICHLOROETHANE], DDE [DICHLORODIPHENYLDICHLOROETHENE], AND DDD [DICHLORODIPHENYLDICHLOROETHANE]
EBS – ENVIRONMENTAL BASELINE SURVEY
IR – INSTALLATION RESTORATION (PROGRAM)
mg/kg – MILLIGRAMS PER KILOGRAM
PCB – POLYCHLORINATED BIPHENYL

Feasibility Study for IR Site 24

Figure 6-3

Conceptual Design for Alternative 5: Sediment Removal/Dredging

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 9/16/08
File No.: 087L15764
Job No.: 23818-087
Rev No.: I

TABLES

Table 2-1
Available Data From IR Site 24 Sampling Locations

Station	Year	SAMPLE TYPE		Toxicity Tests [a]	Bioaccumulation Test	SEDIMENT CHEMISTRY PARAMETERS																				TISSUE CHEMISTRY PARAMETERS									
		Grab	Core			Grain Size	TOC	SEM/AVS	TPH	PAHs	SVOCs	PCB Aroclors	PCB Congeners	2,4'-DDx	4,4'-DDx	Pesticides	BOD	Ammonia	Metals	pH	Salinity	Sulfides	Radionuclides	Butyltins	Percent Moisture	PAHs	SVOCs	PCB Aroclors	PCB Congeners	2,4'-DDx	4,4'-DDx	Pesticides	Metals	Percent Moisture	Butyltins
SS003	1996	X	— [b]	—	—	X	X	X	X	X	X	X	—	—	—	X	X	X	X	X	X	X	—	X	X	—	—	—	—	—	—	—	—	—	—
SS004	1996	X	—	—	—	X	X	X	X	X	X	X	—	—	—	X	X	X	X	X	X	X	—	X	X	—	—	—	—	—	—	—	—	—	—
SS005	1996	X	—	—	—	X	X	X	X	X	X	X	—	—	—	X	X	X	X	X	X	X	—	X	X	—	—	—	—	—	—	—	—	—	—
SS1	1997	X	—	—	—	—	—	—	—	X	X	—	—	—	—	—	—	—	X	—	—	—	—	—	X	—	—	—	—	—	—	—	—	—	—
SS2	1997	X	—	—	—	—	—	—	—	X	X	—	—	—	—	—	—	—	X	—	—	—	—	—	X	—	—	—	—	—	—	—	—	—	—
SS3	1997	X	—	—	—	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—	—	—	—	X	—	—	—	—	—	—	—	—	—	—
SS4	1997	X	—	—	—	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—	—	—	—	X	—	—	—	—	—	—	—	—	—	—
SS5	1997	X	—	—	—	—	—	—	—	X	X	—	—	—	—	—	—	—	X	—	—	—	—	—	X	—	—	—	—	—	—	—	—	—	—
SS9	1997	X	—	—	—	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—	—	—	—	X	—	—	—	—	—	—	—	—	—	—
SS11	1997	X	—	—	—	—	—	—	—	X	X	—	—	—	—	—	—	—	X	—	—	—	—	—	X	—	—	—	—	—	—	—	—	—	—
SS13	1997	X	—	—	—	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—	—	—	—	X	—	—	—	—	—	—	—	—	—	—
SS14	1997	X	—	—	—	—	—	—	—	X	X	—	—	—	—	—	—	—	X	—	—	—	—	—	X	—	—	—	—	—	—	—	—	—	—
SS15	1997	X	—	—	—	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—	—	—	—	X	—	—	—	—	—	—	—	—	—	—
SS16	1997	X	—	—	—	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—	—	—	—	X	—	—	—	—	—	—	—	—	—	—
SS17	1997	X	—			—	—	—	—	—	—	—	—	—	—	—	—	—	X	—	—	—	—	—	X	—	—	—	—	—	—	—	—	—	—
SS19	1997	X	—			—	—	—	—	—	—	—	—	—	—	—	—	—	X	—	—	—	—	—	X	—	—	—	—	—	—	—	—	—	—
SS21	1997	X	—	—	—	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—	—	—	—	X	—	—	—	—	—	—	—	—	—	—
SS22	1997	X	—			—	—	—	—	—	—	—	—	—	—	—	—	—	X	—	—	—	—	—	X	—	—	—	—	—	—	—	—	—	—
SS24	1997	X	—			—	—	—	—	—	—	—	—	—	—	—	—	—	X	—	—	—	—	—	X	—	—	—	—	—	—	—	—	—	—
SS25	1997	X	—	—	—	—	—	—	—	X	X	—	—	—	—	—	—	—	X	—	—	—	—	—	X	—	—	—	—	—	—	—	—	—	—
SS26	1997	X	—	—	—	—	—	—	—	X	X	—	—	—	—	—	—	—	X	—	—	—	—	—	X	—	—	—	—	—	—	—	—	—	—
SS27	1997	X	—	—	—	—	—	—	—	X	X	—	—	—	—	—	—	—	X	—	—	—	—	—	X	—	—	—	—	—	—	—	—	—	—
SS28	1997	X	—	—	—	—	—	—	—	X	X	—	—	—	—	—	—	—	X	—	—	—	—	—	X	—	—	—	—	—	—	—	—	—	—
SS29	1997	X	—	—	—	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—	—	—	—	X	—	—	—	—	—	—	—	—	—	—
SS30	1997	X	—	—	—	—	—	—	—	X	X	—	—	—	—	—	—	—	X	—	—	—	—	—	X	—	—	—	—	—	—	—	—	—	—
SS31	1997	X	—	—	—	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—	—	—	—	X	—	—	—	—	—	—	—	—	—	—
PA01	1998	X	—	E, N, S	Laboratory tests with *Macoma*	X	X	—	—	X	X	—	X	X	X	X	—	—	X	—	—	—	—	X	X	X	X	—	X	X	X	X	X	X	X
PA02	1998	X	—	E, N, S	Laboratory tests with *Macoma*	X	X	—	—	X	X	—	X	X	X	X	—	—	X	—	—	—	—	X	X	X	X	—	X	X	X	X	X	X	X
PA03	1998	X	—	E, N, S	Laboratory tests with *Macoma*	X	X	—	—	X	X	—	X	X	X	X	—	—	X	—	—	—	—	X	X	X	X	—	X	X	X	X	X	X	X
PA04	1998	X	—	E, N, S	Laboratory tests with *Macoma*	X	X	—	—	X	X	—	X	X	X	X	—	—	X	—	—	—	—	X	X	X	X	—	X	X	X	X	X	X	X
PA05	1998	X	—	E, N, S	Laboratory tests with *Macoma*	X	X	—	—	X	X	—	X	X	X	X	—	—	X	—	—	—	—	X	X	X	X	—	X	X	X	X	X	X	X

Table 2-1 (continued)

		SAMPLE TYPE				SEDIMENT CHEMISTRY PARAMETERS																				TISSUE CHEMISTRY PARAMETERS									
Station	Year	Grab	Core	Toxicity Tests [a]	Bioaccumulation Test	Grain Size	TOC	SEM/AVS	TPH	PAHs	SVOCs	PCB Aroclors	PCB Congeners	2,4'-DDx	4,4'-DDx	Pesticides	BOD	Ammonia	Metals	pH	Salinity	Sulfides	Radionuclides	Butyltins	Percent Moisture	PAHs	SVOCs	PCB Aroclors	PCB Congeners	2,4'-DDx	4,4'-DDx	Pesticides	Metals	Percent Moisture	Butyltins
PA C-1	2005	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—
PA C-2	2005	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—
PA C-3	2005	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—
PA C-4	2005	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—
PA C-5	2005	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	X	X	X	—	—	—	—	—	—	—	—	—	—
PA C-6	2005	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—
PA C-7	2005	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—
PA C-8	2005	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—
PA C-9	2005	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—
PA C-10	2005	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—
PA C-11	2005	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—
PA C-12	2005	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—
PA C-13	2005	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	X	X	X	—	—	—	—	—	—	—	—	—	—
PA C-14	2005	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—
PA C-15	2005	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—
PA C-16	2005	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	X	X	X	—	—	—	—	—	—	—	—	—	—
PA C-17	2005	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—
PA C-18	2005	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—
PA C-19	2005	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—
REF	2005	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—
PA C-20	2006	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—
PA C-21	2006	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—
PA C-22	2006	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—
PA C-23	2006	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—
PA C-24	2006	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—
PA C-25	2006	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—
PA C-26	2006	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—
PA C-27	2006	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—
PA C-28	2006	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—
PA C-29	2006	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—
PA C-30	2006	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—
PA C-31	2006	—	X	—	—	X	X	—	—	X	—	X	X	—	—	X	—	—	X	—	—	—	—	X	X	—	—	—	—	—	—	—	—	—	—

Table 2-1 (continued)

Source:
Battelle et al. 2007

Notes:
[a] E = *Eohaustorius estuarius* 10-day bulk sediment bioassay to evaluate present survival
N = *Neanthes arenaceodentata* 28-day bulk sediment bioassay to evaluate percent survival and percent growth
S = *Strongylocentrotus purpuratus* sediment water interface test to evaluate percent survival and percent of normal larvae development
[b] sample not collected or parameter not analyzed

Acronyms/Abbreviations:
BOD – biological oxygen demand
DDD – dichlorodiphenyldichloroethane
DDE – dichlorodiphenyldichloroethylene
DDT – dichlorodiphenyltrichloroethane
DDx – sum of the pesticides DDT, DDE, and DDD
IR – Installation Restoration (Program)
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
REF – reference
SEM/AVS – simultaneously extracted metals/acid volatile sulfide test
SVOC – semivolatile organic compound
TOC – total organic carbon
TPH – total petroleum hydrocarbons

Table 2-2
2005 and 2006 Sediment Results for Chemicals of Potential Ecological Concern

Analyte	Preliminary RG	ER-M	Depth (cm)	PA C-1	PA C-2	PA C-3	PA C-4	PA C-5	PA C-6	PA C-7	PA C-8	PA C-9	PA C-10	PA C-11	PA C-12	PA C-13	PA C-14	PA C-15	PA C-16	PA C-17	PA C-18
Polycyclic Aromatic Hydrocarbons (μg/kg)																					
HPAH6[a]	—[b]	9,600	0–5	2,757	857	1,573	2,137	3,057	1,506	1,514	1,215	3,019	3,728	2,330	2,498	2,811	1,401	1,191	7,065	7,970	1,101
			5–25	1,099	803	1,305	1,683	1,941	1,189	956	766	2,618	3,568	1,735	2,325	2,076	1,062	924	8,296	3,504	874
			25–50	1,243	433	1,078	1,489	1,506	967	923	734	2,433	2,284	590	1,267	1,309	779	578	6,163	2,015	571
LPAH6[c]	—	3,160	0–5	1,411	224	430	743	1,160	338	440	336	1,267	999	599	500	470	281	300	1,647	1,868	228
			5–25	177	136	247	295	309	227	187	139	372	470	252	315	303	165	149	996	458	132
			25–50	178	74	178	230	221	174	171	128	324	291	84	200	193	131	91	645	290	94
Pesticides/Polychlorinated Biphenyls (μg/kg)																					
alpha-chlordane	—	6	0–5	0.06 U	0.06 U	0.06 U	0.05 U	0.67	0.5	0.47	0.06 U	0.49	0.44	0.5	0.41	0.47	0.52	0.06 U	0.68	0.44	0.38
			5–25	0.06 U	0.07 U	0.06 U	0.06 U	0.49	0.47	0.48	0.06 U	0.5	0.4	0.41	0.41	0.46	0.4	0.41	0.66	0.37	0.41
			25–50	0.06 U	0.06 U	0.06 U	0.06 U	0.42	0.43	0.44	0.05 U	0.43	0.49	0.38	0.41	0.41	0.39	0.37	0.6	0.31	0.38
dieldrin	—	8	0–5	0.73	0.65	0.66	0.58	0.09 U	0.05 U	0.05 U	0.62	0.06 U	0.05 U	0.06 U	0.06 U	0.06 U	0.07 U	0.61	0.05 U	0.06 U	0.06 U
			5–25	0.69	0.67	0.72	0.73	0.06 U	0.06 U	0.05 U	0.62	0.06 U	0.05 U	0.06 U	0.06 U	0.06 U	0.05 U	0.06 U	0.05 U	0.05 U	0.06 U
			25–50	0.7	0.57	0.68	0.73	0.05 U	0.06 U	0.05 U	0.57	0.05 U	0.06 U	0.06 U	0.06 U	0.05 U	0.05 U	0.06 U	0.05 U	0.04 U	0.06 U
total 4,4'-DDx[d]	130	46	0–5	4.63	4.5	5.04	5.05	8.53	6.93	6.79	4.51	6.75	6.65	5.57	4.7	5.15	6.16	4.7	9.97	5.38	4.06
			5–25	4.33	4.8	5.34	4.7	7.16	5.06	6.54	4.95	7.18	6.01	4.48	4.95	6.23	4.73	5.53	9.91	4.41	4.3
			25–50	4.87	3.2	5	4.48	6.28	5.66	6.36	4.33	7.22	6.61	3.52	4.8	4.39	4.68	4.29	6.115	4.64	4.97
total 2,4'- and 4,4'-DDx[d]	—	46	0–5	4.74	4.62	5.15	5.15	8.72	7.04	6.9	4.62	6.87	6.76	5.7	4.83	5.27	6.32	4.81	10.08	5.5	4.18
			5–25	4.45	4.92	5.45	4.82	7.28	5.18	6.65	5.06	7.30	6.11	4.6	5.07	6.35	4.84	5.66	10.02	4.51	5.17
			25–50	4.98	3.31	5.12	4.59	6.39	5.78	6.47	4.43	7.33	6.73	3.64	4.92	4.5	4.79	4.41	6.22	4.73	5.7
total PCBs[e]	1,130[e]	180	0–5	38.5	26.9	26.6	27.6	49.1	39.4	25.8	26.9	38.9	26.4	18.5	12.6	36.2	15.0	27.5	353.4	33.9	9.3
			5–25	31.3	30.4	31.1	28.9	64.6	64.7	26.7	26.4	45.0	26.5	13.4	14.2	59.6	22.1	13.2	321.3	29.4	12.4
			25–50	28.5	19.6	30.4	29.5	53.8	58.9	32.4	22.7	40.3	27.1	6.6	16.2	31.7	18.7	14.8	245.7	24.9	11.2
Butyltins (μg/kg)																					
tributyltin	—	—	0–5	1.6	1.5	1.3	0.89	1.7	0.78	0.92	2.2	1.6	1.6	2	2	3.8	2.7	4.2	40	3.2	1.7
			5–25	1.1	1.1	1.1	0.88	1.7	1.6	1.2	0.89	2	1.3	2.7	2.3	6.2	3	2.1	48	2.4	4.1
			25–50	0.88	1.1	0.86	1.3	1.8	1.6	1.5	1	2.5	1.1	2.7	1.6	3	4.2	2.5	18	0.17 U	1.5
Metals (mg/kg)																					
cadmium	24.4	9.6	0–5	0.286	0.249	0.211	0.265	0.263	0.309	0.174	0.24	0.237	0.239	0.252	0.217	0.458	0.27	0.228	7.34	0.463	0.222
			5–25	0.376	0.274	0.251	0.286	0.323	0.248	0.234	0.246	0.303	0.331	0.332	0.292	1.27	0.349	0.24	7.48	0.522	0.317
			25–50	0.284	0.299	0.29	0.322	0.317	0.299	0.233	0.162	0.268	0.304	0.37	0.303	0.695	0.366	0.262	6.81	0.288	0.291
chromium	—	370	0–5	95.6	102	99.2	109	89.8	94	84.2	104	85.4	92.2	108	107	89	95.4	103	167	98.6	99.7
			5–25	103	104	97.9	102	103	92.4	92.6	105	86.9	86.9	96.1	99.6	104	104	104	136	94.2	93.3
			25–50	94.5	103	107	97.4	101	94.3	83.2	94	83.8	97.9	88.9	94.8	89.1	106	95.4	113	64.8	111

Table 2-2 (continued)

Analyte	Preliminary RG	ER-M	Depth (cm)	PA C-1	PA C-2	PA C-3	PA C-4	PA C-5	PA C-6	PA C-7	PA C-8	PA C-9	PA C-10	PA C-11	PA C-12	PA C-13	PA C-14	PA C-15	PA C-16	PA C-17	PA C-18
Metals (mg/kg) (continued)																					
copper	—	270	0–5	38.7	43	39.3	40.6	48.9	46.2	35.4	38.4	45.3	50.2	47.8	42.8	44.3	47.7	44.8	131	70.9	42.8
			5–25	44.1	40.3	41.6	43.2	51.1	46.8	40.8	37.4	54.8	52.6	52.6	49.7	66.3	49.1	43.4	116	60.6	45.5
			25–50	37.7	41	42.2	42.3	47.1	44.6	39.6	32.9	45.6	49.6	48.4	40.9	52.7	47.7	42	109	25.5	41.4
lead	—	218	0–5	26.1	27.3	22.9	24.8	27.3	32.8	21.5	26.1	25.5	25.5	26.9	27.3	24	27.6	28.2	79.8	29.8	25.3
			5–25	30.9	25.8	27.2	27.2	30.5	27.9	26.2	26.8	28.3	27.9	28.5	27.2	37.5	27.6	28.1	88.2	28.2	26.4
			25–50	26.4	29	27.7	26.4	92.8	27.1	25.5	20.1	25.8	26.6	27.4	26.9	30.2	29	27.1	67.2	16.2	29.2
mercury	—	0.71	0–5	0.314	0.31	0.25	0.304	0.259	0.286	0.226	0.215	0.289	0.326	0.264	0.293	0.337	0.358	0.238	0.288	0.345	0.304
			5–25	0.328	0.295	0.309	0.31	0.314	0.317	0.253	0.268	0.328	0.234	0.344	0.294	0.322	0.332	0.299	0.353	0.264	0.288
			25–50	0.31	0.284	0.312	0.257	0.297	0.3	0.278	0.286	0.305	0.307	0.313	0.306	0.32	0.311	0.302	0.0023	0.177	0.305
silver	—	3.7	0–5	0.32	0.318	0.332	0.307	0.335	0.311	0.261	0.28	0.322	0.304	0.293	0.304	0.452	0.343	0.32	4.61	0.418	0.312
			5–25	0.369	0.327	0.318	0.344	0.378	0.339	0.302	0.297	0.365	0.356	0.363	0.332	0.724	0.531	0.332	3.83	0.411	0.328
			25–50	0.341	0.342	0.313	0.344	0.345	0.353	0.306	0.297	0.335	0.336	0.404	0.31	0.519	0.407	0.321	2.95	0.278	0.318
zinc	—	410	0–5	82.4	91.5	80.7	82.2	93.2	98.9	73	83.9	87.6	90.5	91.9	88.2	75.3	92.8	93.2	148	101	84.9
			5–25	89.8	79.6	86.2	89.9	90	90.1	83	80.6	93.1	92.3	90.4	86.8	102	88.3	85.8	142	89.3	81
			25–50	79.3	86	83.2	88.7	86.8	86.4	82	68.2	85.8	87.8	87.8	83.1	88.9	88.5	82.2	135	51.9	82.7

Table 2-2 (continued)

Analyte	Preliminary RG	ER-M	Depth (cm)	PA C-19	PA C-20	PA C-21	PA C-22	PA C-23	PA C-24	PA C-25	PA C-26	PA C-27	PA C-28	PA C-29	PA C-30	PA C-31
Polycyclic Aromatic Hydrocarbons (µg/kg)																
HPAH6[a]	—	9,600	0–5	6,251	14,403	6,588	32,053	52,709	10,241	16,582	12,793	3,708	13,287	1,264	6,345	6,808
			5–25	1,271	9,129	17,716	9,390	12,862	11,803	14,923	7,415	1,609	8,315	1,430	5,986	7,112
			25–50	1,548	1,517	2,539	10,178	3,120	4,598	15,513	1,573	397	3,017	502	4,158	2,310
LPAH6[c]	—	3,160	0–5	1,595	2,420	642	25,727	20,795	1,379	4,045	4,130	894	8,156	157	1,701	1,599
			5–25	515	1,593	20,241	1,762	3,879	2,010	2,567	634	209	1,139	384	2,738	2,409
			25–50	230	115	4,110	1,142	489	6,055	3,969	238	62	389	69	944	919
Pesticides/Polychlorinated Biphenyls (µg/kg)																
alpha-chlordane	—	6	0–5	0.03 U	0.63	0.83	0.33	1.03	1.11	0.64	0.4	0.69	0.54	0.73	0.26	0.19
			5–25	0.03 U	1.15	2.85	0.3	0.44	3.98	0.56	0.9	0.31	0.33	0.29	0.02 U	0.22
			25–50	0.03 U	0.18	0.54	0.18	0.02 U	1.01	0.02 U	0.02 U	0.09	0.02 U	0.02 U	0.5	0.02 U
dieldrin	—	8	0–5	0.32	3.21	2.5	2.43	22.35	8.07	4.02	3.3	3.5	2.67	2.01	3.52	2.33
			5–25	1.22	3.53	10.65	1.76	5.4	8.92	1.01	3.53	2.71	1.64	1.24	0.64	2.06
			25–50	0.45	1.11	2.18	3.41	0.32	2.93	2.03	0.02 U	0.02 U	0.02 U	0.02 U	2.33	0.59
total 4,4'-DDx[d]	130	46	0–5	1.86	27.78	14.81	9.71	118.52	54.74	14.76	10.74	9.6	49.24	10.26	8.72	3.23
			5–25	1.53	27.62	96.13	8.63	6.45	93.61	10.9	11.01	4.83	33.32	4.35	6.53	2.51
			25–50	2.44	4.34	19.99	6.75	0.52	64.17	15.27	0.49	1.79	2.9	0.23	13.16	0.48
total 2,4'- and 4,4'-DDx[d]	—	46	0–5	1.92	39.27	21.16	17.81	166.30	70.71	22.08	16.93	13.95	69.49	15.15	16.21	5.24
			5–25	1.59	37.46	131.58	12.72	12.25	124.24	15.74	18.81	7.11	45.37	7.30	10.31	2.57
			25–50	2.5	5.87	26.24	9.86	1.28	85.52	22.19	0.98	2.43	4.45	0.46	18.78	0.54
total PCBs[e]	1,130[e]	180	0–5	37.2	891.4	491.0	201.0	***3,137.6***[f]	***1,323.5***[f]	331.0	420.6	394.6	341.7	241.3	137.2	81.1
			5–25	40.8	733.5	***4,770.4***[f]	223.8	287.4	***3,721.3***[f]	356.8	304.5	275.5	157.3	144.9	107.0	85.3
			25–50	71.9	277.1	1,079.7	188.1	37.1	***2,428.6***[f]	491.4	51.7	69.8	24.1	18.1	265.7	25.4
Butyltins (µg/kg)																
tributyltin	—	—	0–5	2.8	300	320	25	750	890	39	17	82	11	140	11	23
			5–25	0.078 U	160	47	33	15	370	25	9.8	14	4.5	320	11	20
			25–50	0.75	12	4.9	15	0.31 U	3.1	7.5	0.45	2.7	0.11 U	8.4	8.8	1.3
Metals (mg/kg)																
cadmium	24.4	9.6	0–5	0.142	***37.7***[f]	13.2	4.38	18.6	***37.8***[f]	8.46	9.99	4.58	6.64	2.08	1.46	1.31
			5–25	0.129	***31.2***[f]	***188***[f]	4.79	6.26	***70.9***[f]	10.4	5.67	4.34	4.6	1.81	1.76	1.67
			25–50	0.185	8.57	***34.2***[f]	6.01	0.616	***282***[f]	7.65	0.841	1.3	0.605	0.282	4.41	0.363
chromium	—	370	0–5	41.7	360	270	139	262	380	285	138	110	104	65.5	66.7	64.9
			5–25	34.3	164	799	147	148	699	176	137	96.9	108	82.3	87.9	73.3
			25–50	42.4	105	166	173	101	753	167	137	60.3	90.7	35.4	87.4	33.1

Table 2-2 (continued)

Analyte	Preliminary RG	ER-M	Depth (cm)	PA C-19	PA C-20	PA C-21	PA C-22	PA C-23	PA C-24	PA C-25	PA C-26	PA C-27	PA C-28	PA C-29	PA C-30	PA C-31
Metals (mg/kg) (continued)																
copper	—	270	0–5	18.5	173	108	126	114	247	117	121	116	96.7	124	69.9	56.6
			5–25	13.8	173	186	144	61.8	200	130	82	48.2	75.3	372	94.2	49.9
			25–50	14.3	29.6	26.3	131	39.6	114	54.7	45.6	17.7	51.2	10.7	53.8	10.3
lead	—	218	0–5	12.2	498	246	65	227	402	140	116	97.3	115	60.1	39.5	78.2
			5–25	7.73	149	2,290	69.1	69.1	654	224	77	59.1	88.1	87.6	51.6	51.1
			25–50	38.9	79.5	227	83.6	51.8	1,600	246	30.2	16	24.6	12.5	60.7	10.8
mercury	—	0.71	0–5	0.109	0.167	0.0793	0.0824	0.14	0.182	0.107	0.113	0.101	0.178	0.0546	0.089	0.0669
			5–25	0.0869	0.117	0.742	0.11	0.16	0.383	0.167	0.162	0.0665	0.232	0.0668	0.0993	0.0771
			25–50	0.0964	0.0353	0.0951	0.119	0.247	0.128	0.263	0.188	0.026	0.202	0.0635	0.121	0.0524
silver	—	3.7	0–5	0.11	20.5	10.3	1.9	11.9	47	4.12	3.98	5.92	1.41	1.37	0.741	1.04
			5–25	0.099	20.9	47	2.3	2.52	70.6	5.22	2	3.32	0.83	1.1	0.927	1.16
			25–50	0.1	3.75	15.5	2.6	0.332	35.2	2.41	0.343	1.09	0.263	0.091	1.97	0.123
zinc	—	410	0–5	41.1	205	129	164	276	287	723	155	126	177	70	87.9	79.3
			5–25	31.3	143	587	177	133	334	632	153	89.9	183	111	118	120
			25–50	44.9	58.1	72	205	100	233	231	110	42.6	99.8	29.2	106	26.2

Source:
Analytical results taken from Battelle et al. 2007; sampling results from 2005/2006

Review Qualifier:
U – not reported at concentration above detection limit

Notes:
[a] HPAH6 = sum of six PAHs: benz(a)anthracene, benzo(a)pyrene, chrysene, dibenz(a,h)anthracene, fluoranthene, and pyrene; chemical concentrations that were not detected were set to one-half the reported detection limits; calculated by BEI using results presented in Battelle et al. 2007
[b] not available for this constituent
[c] LPAH6 = sum of six PAHs: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene; chemical concentrations that were not detected were set to one-half the reported detection limits; calculated by BEI using results presented in Battelle et al. 2007
[d] total 2,4'-DDx = sum of 2,4'-DDD, 2,4'-DDE, and 2,4'-DDT; total 4,4'-DDx = sum of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT; chemical concentrations that were not detected were set to one-half the reported detection limits; calculated by BEI using results presented in Battelle et al. 2007
[e] total PCBs = sum of 20 PCB congener concentrations and multiplied by two; chemical concentrations that were not detected were set to one-half the reported detection limits; calculated by BEI using results presented in Battelle et al. 2007. Area-wide average concentration of total PCBs not to exceed 0.2 mg/kg
[f] bold and italicized indicates value exceeding the preliminary RG; see Section 3 of this FS Report

Acronyms/Abbreviations:
BEI – Bechtel Environmental, Inc.
cm – centimeters
COPEC – chemical of potential ecological concern
DDD – dichlorodiphenyldichloroethane
DDE – dichlorodiphenyldichloroethylene
DDT – dichlorodiphenyltrichloroethane
ER-M – effects range-median
FS – feasibility study
HPAH – high-molecular-weight polycyclic aromatic hydrocarbon
LPAH – low-molecular-weight polycyclic aromatic hydrocarbon
µg/kg – micrograms per kilogram
mg/kg – milligrams per kilogram
PAH – polycyclic aromatic hydrocarbon
PCB – polychlorinated biphenyl
RG – remediation goal

Table 2-3
Range of Concentrations for Chemicals of Potential Ecological Concern[a]

COPEC	IR Site 24 Surface Sediment (0–5 cm)	IR Site 24 Subsurface Sediment (5–25 cm)	IR Site 24 Subsurface Sediment (25–50 cm)
Inorganic compounds, mg/kg			
cadmium	0.142 – 37.8	0.129 – 188	0.162 – 282
chromium	41.7 – 380	34.3 – 799	33.1 – 753
copper	18.5 – 247	13.8 – 372	10.3 – 131
lead	12.2 – 498	7.73 – 2,290	10.8 – 1,600
mercury	0.0546 – 0.358	0.0665 – 0.742	0.0023 – 0.32
silver	0.11 – 47	0.099 – 70.6	0.091 – 35.2
zinc	41.1 – 723	31.3 – 632	26.2 – 233
Organic compounds, µg/kg			
alpha-chlordane	0.03 U – 1.11	0.03 U – 3.98	0.02 U – 1.01
dieldrin	0.05 U – 22.35	0.05 U – 10.65	0.02 U – 3.41
tributyltin	0.78 – 890	0.078 U – 370	0.11 U – 18
total 4,4'-DDx[b]	1.86 – 118.52	1.53 – 96.13	0.23 – 64.17
total 2,4'- and 4,4'-DDx[b]	1.92 – 166.30	1.59 – 131.58	0.46 – 85.52
total PCBs	9.3 – 3,137.6	12.4 – 4,770.4	6.6 – 2,428.6
HPAH6[c]	857 – 52,709	766 – 17,716	397 – 15,513
LPAH6[d]	157 – 25,727	132 – 20,241	62 – 6,055

Review Qualifier:

U – not reported at a concentration above the detection limit

Notes:

[a] sampling results from 2005/2006

[b] total 2,4'-DDx = sum of 2,4'-DDD, 2,4'-DDE, and 2,4'-DDT; total 4,4'-DDx = sum of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT

[c] HPAH6 = sum of six PAHs: benz(a)anthracene, benzo(a)pyrene, chrysene, dibenz(a,h)anthracene, fluoranthene, and pyrene

[d] LPAH6 = sum of six PAHs: acenaphthene, acenaphthylene, anthracene, fluorene, naphthalene, and phenanthrene

Acronyms/Abbreviations:

cm – centimeters
COPEC – chemical of potential ecological concern
DDD – dichlorodiphenyldichloroethane
DDE – dichlorodiphenyldichloroethylene
DDT – dichlorodiphenyltrichloroethane
HPAH – high-molecular-weight polycyclic aromatic hydrocarbon
IR– Installation Restoration (Program)
LPAH – low-molecular-weight polycyclic aromatic hydrocarbon
µg/kg – micrograms per kilogram
mg/kg – milligrams per kilogram
PCB – polychlorinated biphenyl

Table 3-1
Comparison of Concentrations of Chemicals of Concern at IR Sites 24 (Pier Area) and 17 (Seaplane Lagoon)

COC[a]	IR Site 24[b] Range of Concentrations	IR Site 17[c] Range of Concentrations
Inorganic compounds, mg/kg		
cadmium	0.142 – 37.8	0.05U – 57.3
lead	12.2 – 498	3.4 – 619
Organic compounds, mg/kg		
total 4,4'-DDx[d]	0.00186 – 0.11852	0.0021 U – 0.2021
total 2,4'-DDx and 4,4'-DDx[d]	0.00192 – 0.166	0.0021 U – 0.2077
total PCBs	0.0093 – 3.1376	0.018 – 2.535

Review Qualifier:
U – not reported at a concentration above the detection limit

Notes:
[a] the IR Site 17 COCs also included chromium, but chromium was not a COC for IR Site 24
[b] surface sediment, 1996, 1997, 1998, and 2005/2006
[c] surface sediment 1993, 1996, 1998, 2002
[d] total 2,4'-DDx = sum of 2,4'-DDD, 2,4'-DDE, and 2,4'-DDT;
total 4,4'-DDx = sum of 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT

Acronyms/Abbreviations:
COC – chemical of concern
DDD – dichlorodiphenyldichloroethane
DDE – dichlorodiphenyldichloroethylene
DDT – dichlorodiphenyltrichloroethane
IR– Installation Restoration (Program)
mg/kg – milligrams per kilogram
PCB – polychlorinated biphenyl

Table 3-2
Preliminary Remediation Goals

COC	Sediment Ecological Preliminary RG[1], mg/kg
cadmium	24.4
total DDx	0.13
total PCBs	1.13[2]

Notes:

[1] preliminary RGs were calculated using this formula:
preliminary RG = $(BW*TRV*SUF^{-1})/([IR_{FOOD}*BAF]+IR_{SED})$
where: preliminary RG = sediment ecological preliminary remediation goal (sediment concentration)
BW = receptor body weight
TRV = toxicity reference value
SUF = receptor site use factor
IR_{FOOD} = receptor ingestion rate for food
BAF = sediment-to-food bioaccumulation factor
IR_{SED} = receptor ingestion rate for incidental sediment

[2] consideration will be given to achieving an areawide average total PCB concentration that is consistent with the upper-bound nearshore ambient concentration for total PCBs (i.e., 0.2 mg/kg); the area-weighted average total PCB concentrations within IR Site 24 following remediation will be comparable to the upper bound estimate (i.e., 0.2 mg/kg) of the nearshore ambient concentration calculated for the San Francisco Bay area

Acronyms/Abbreviations:
COC – chemical of concern
DDx – sum of the pesticides dichlorodiphenyltrichloroethane (DDT), dichlorodiphenyldichloroethylene (DDE), and dichlorodiphenyldichloroethane (DDD)
mg/kg – milligrams per kilogram
PCB – polychlorinated biphenyl
RG – remediation goal

Table 3-3
Exposure Factors for Calculations of Revised Lead HQ for the Least Tern

Factors for Least Tern	Values and Units
Ingestion rate, food	0.00975 kg/day
Body weight	0.045 kg
Bioaccumulation factor	0.0173 kg-sediment/kg-food
Toxicity reference value, receptor-adjusted	0.0124 mg/kg-day
IR Site 24 lead exposure point concentration	75.7 mg/kg
Ambient lead concentration	43.2 mg/kg
Site use factor	10 percent

Acronyms/Abbreviations:
IR– Installation Restoration (Program)
kg – kilograms
kg/day – kilograms per day
kg-sediment/kg-food – kilograms of sediment per kilogram of food
mg/kg – milligrams per kilogram
mg/kg-day – milligrams per kilogram per day

Table 4-1
Identification of Remedial Process Options for Sediment

General Response Action	Remedial Technology	Process Option
No action	None	**No action***
Institutional controls	Institutional controls	**Legal and administrative mechanisms***
Monitoring	Sediment monitoring	**Bathymetric survey, sediment sampling and analysis***
Monitored natural recovery	Sediment sampling and analysis	**Sediment sampling and analysis, natural recovery monitoring***
Containment	Capping	**Thin-layer cap***
Removal	Sediment removal/dredging	**Mechanical dredging***
		Hydraulic dredging*
Disposal	Sanitary/hazardous waste landfill	**Off-site disposal*** On-site disposal
	Confined disposal facility	On-site or nearshore disposal
	Contained aquatic disposal	On-site or offshore disposal
In situ treatment	Biological treatment	*In situ* bioremediation
	Physical treatment	**Solidification, stabilization, grouting***
	Chemical treatment	Nanoscale iron amendment

Note:
* bold type indicates process option was retained for further evaluation

Table 4-2
Technology Screening Criteria

Effectiveness	Implementability	Cost
• **Ability to achieve RAOs for the protection of human health and the environment.** Technologies incapable of attaining chemical-specific ARARs or cleanup goals or those that would not effectively contribute to the protection of public health or the environment are not considered further. • **Permanent reduction in toxicity, mobility, or volume of contaminants in affected sediment.** Technologies that permanently reduce contaminant toxicity, mobility or volume are preferred. • **Long-term risks of treatment residuals or containment systems.** Technologies with significantly lower long-term risks are preferred. • **Risks to the public, workers, or the environment during technology implementation.** Technologies posing less risk during implementation are preferred.	• **Site characteristics limiting the construction or effective functioning of a technology.** Technologies limited by site conditions are eliminated. • **Waste or media characteristics that limit the use or effective functioning of a technology.** Technologies limited by waste or media characteristics are eliminated. • **Availability of equipment needed to implement a technology and the capacity of required off-site treatment or disposal facilities.** Commercially developed technologies that are readily available or innovative technologies that have been pilot tested are preferred. • **Administrative feasibility of obtaining permits and approvals from regulatory agencies and other offices.** Technologies are eliminated if the permitting process is judged to be prohibitively difficult.	• **Relative cost.** Cost criteria used to screen remedial technologies are qualitative and based on engineering judgment unless otherwise noted. The relative magnitude of capital costs, pilot-scale testing and mobilization costs, as well as O&M costs, is considered when process options within a technology are compared. Process options with lower costs are preferred if the effectiveness and implementability criteria are comparable.

Acronyms/Abbreviations:
ARAR – applicable or relevant and appropriate requirement
O&M – operation and maintenance
RAO – remedial action objective

Table 4-3
Screening of Remedial Technologies and Process Options for Sediment

General Response Action	Remedial Technology	Process Option	Description	Effectiveness	Implementability	Cost	Conclusion
No action	None	No action	No response action for sediment.	Does not include any monitoring, sampling, or remediation activities, and does not restrict future uses of the site.	Readily implementable because no action would be required.	No direct costs.	Retained as required by CERCLA.
ICs	ICs	Legal and administrative mechanisms	ICs are nonengineering measures designed to prevent disturbance of impacted sediment left in place at a site, or to assure the effectiveness of a selected remedy.	Should be effective in minimizing disturbance of impacted sediment.	Readily implementable. There is a precedent for the use of ICs at Alameda Point.	Moderate in cost compared to other process options. Total cost would depend on the duration of ICs.	Retained for further consideration.
Monitoring	Sediment monitoring	Bathymetric survey, sediment sampling and analysis	Site conditions and concentrations of contaminants in sediment are evaluated over time to monitor extent and migration of contaminants.	Not effective as a stand-alone option to reduce the mass, volume, or toxicity of contaminants in sediment. The method is effective as a means of verifying COC concentrations in sediment and assessing remediation progress.	Readily implementable, as demonstrated by previous sediment investigations at IR Site 24 and Alameda Point.	Low capital cost. Moderate to high O&M cost, depending on the number of sampling locations in the monitoring program, sampling frequency, and duration of the monitoring program.	Retained for further consideration as a component of remedial alternatives.
MNR	Sediment sampling and analysis	Sediment sampling and analysis, natural recovery monitoring	Naturally occurring *in situ* processes (e.g., sediment deposition) reduce contamination over time. Sediment monitoring is performed to check the progress of MNR.	Under suitable conditions, MNR should be effective in reducing risk associated with COCs in sediment over the long term.	Readily implementable. Sampling and analytical methods are available to monitor sediment deposition rates and changes in contaminant concentrations in sediment.	Low capital cost and moderate to high O&M cost. Total cost is dependent on the MNR effectiveness and duration to reach RAOs.	Retained for further consideration.
Containment	Capping	Thin-layer cap	A subaqueous cap of clean granular material is placed over impacted sediment to isolate contaminants from the surrounding environment and potential receptors.	Should be effective in limiting exposure to impacted sediment.	Implementable. It usually requires less infrastructure (e.g., materials handling, treatment, or disposal facilities) and is less disruptive than dredging.	Expected to be moderate to high in cost. Total cost is dependent on the size of the area to be capped and the frequency and duration of monitoring..	Retained for further consideration.
Removal	Dredging	Mechanical and hydraulic dredging	Dredging of impacted sediment to remove contaminant mass from the aquatic environment.	Should be effective at addressing any class of contaminant (i.e., organic or inorganic) as it physically and nonselectively removes impacted sediment. Some sediment is released to the water column during dredging, but releases can be minimized with equipment and engineering controls such as silt curtains or silt screens.	Dredging is considered moderately implementable because of the limited access under the wharf road. Dredging underneath structures (e.g., pier, wharf, or road) typically is performed with smaller equipment and may pose technical challenges; therefore, it is less implementable than dredging in open water areas. Dredging may be limited by debris.	Because the area of environmental concern is not extensive, the cost for this process is considered to be low to moderate.	Retained for further consideration.

Table 4-3 (continued)

General Response Action	Remedial Technology	Process Option	Description	Effectiveness	Implementability	Cost	Conclusion
Disposal	Sanitary/ hazardous waste landfill	Off-site or on-site disposal	Impacted sediment is placed in temporary storage facilities and transported to an off-site or on-site treatment or disposal facility.	Off-site or on-site disposal facilities should be effective in isolating impacted sediment and reducing the ecological and environmental risks as long as the integrity of the facility is maintained.	Disposal to an off-site landfill is easily implemented for small quantities of dredged sediment and residual wastes such as those anticipated at IR Site 24. For larger quantities, implementability is moderate to low. Implementability of disposing dredged sediment and residual wastes to an on-site landfill is low because the permitting process to construct and operate an on-site landfill is expected to be prohibitively difficult.	Disposal costs for dredged sediment and residual wastes could range from low to high, depending on the volume. Approvals, permitting, construction, monitoring, and maintenance costs for an on-site landfill are expected to be high.	Disposal to an off-site landfill is retained for further evaluation in combination with dredging. Disposal to an on-site landfill was eliminated from further evaluation based on low implementability and high cost.
	Confined disposal facility	On-site or nearshore disposal	Impacted sediment is placed in an engineered structure enclosed by dikes specifically designed to contain sediment.	Confined disposal facilities should be effective in isolating impacted sediment and reducing the ecological and environmental risks as long as the integrity of the facility is maintained.	Implementability of disposing of dredged sediment to a confined disposal facility is low because the permitting process to construct and operate the facility is expected to be prohibitively difficult.	Approvals, permitting, construction, monitoring, and maintenance costs of a confined disposal facility are expected to be high.	Eliminated from further evaluation based on low implementability and high cost.
	Contained aquatic disposal	On-site or offshore disposal	Dredged sediment is placed into a natural or excavated depression elsewhere in the water body.	Contained aquatic disposal facilities can be effective in isolating impacted sediment and reducing the ecological and environmental risks as long as the sediment is capped and the integrity of the facility is maintained.	Implementability of disposing dredged sediment to a confined aquatic disposal facility is low because the permitting process to construct and operate the facility is expected to be prohibitively difficult.	Approvals, permitting, construction, monitoring, and maintenance costs of a confined aquatic disposal facility are expected to be high.	Eliminated from further evaluation based on low implementability and high cost.
In situ treatment	Biological treatment	ISB	Nutrients and/or microorganisms are added to the impacted sediment to initiate or enhance the microbial degradation of contaminants.	Only effective in degrading organic contaminants in sediment, not inorganic contaminants.	Implementation methods for ISB treatment of sediment have not been thoroughly developed; the implementability of this technology is not completely known. Bench-scale and pilot-scale testing would be necessary prior to full-scale implementation.	May cost less than other remedial options (e.g., dredging and disposal). Cost would depend on the size of the treatment area and the type and volume of reagents or amendments required.	Eliminated from further evaluation based on low effectiveness for inorganic constituents and low implementability.
	Physical treatment	Solidification, stabilization, grouting	Binding agents (e.g., Portland cement, fly ash, limestone, grout) are added and mixed with the sediment to encapsulate the contaminants in a solid matrix and/or chemically alter the contaminants by converting them into a less bioavailable, less mobile, or less toxic form.	Should be effective in binding or encapsulating organic and inorganic contaminants.	The implementability of this technology is not completely known. Bench-scale and pilot-scale testing would be necessary prior to full-scale implementation.	May cost less than other remedial options. Cost would depend on the size of the treatment area and the volume of binding agents required.	Retained for further consideration.
	Chemical treatment	Nanoscale iron amendment	Induces chemical reactions to break down and destroy contaminants in sediment.	Only expected to be effective in chemically treating halogenated organic contaminants. Nanoscale iron reduction of other organic compounds and metals is untested. This technology has not been tested in the field.	The implementability of this technology is not completely known. Bench-scale and pilot-scale testing would be necessary prior to full-scale implementation.	May cost less than other remedial options. Cost would depend on the size of the treatment area and the volume of amendments required.	Eliminated from further evaluation based on unknown effectiveness and low implementability.

Table 4-3 (continued)

Acronyms/Abbreviations:
- CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
- COC – chemical of concern
- IC – institutional control
- IR – Installation Restoration (Program)
- ISB – *in situ* bioremediation
- MNR – monitored natural recovery
- O&M – operation and maintenance
- RAO – remedial action objective

Table 5-1
Identification of Remedial Alternatives

Alternative	Description
1	no action
2	ICs
3	MNR with ICs
4	thin-layer capping with ICs
5	sediment removal/dredging
6*	*in situ* grouting with ICs

Note:
* alternative was not retained for detailed evaluation in Section 6

Acronyms/Abbreviations:
IC – institutional control
MNR – monitored natural recovery

Table 5-2
Screening Results for Sediment Remedial Alternatives

Alternatives	Effectiveness	Implementability	Cost	Conclusion
1 – no action	Not evaluated.	Not evaluated.	Not evaluated.	Retained for DAA per the NCP.
2 – ICs	ICs would be effective to prohibit disturbance of sediments under the wharf road and/or removal of the wharf road.	Readily implementable.	Low to moderate. Costs would depend on the duration of ICs.	Retained for DAA.
3 – MNR with ICs	Natural recovery processes are expected to isolate impacted sediment and reduce exposure to COCs by ecological receptors over time. MNR should be effective in achieving RAOs in sediment over the long term. ICs would be implemented along with MNR until RAOs were met.	Readily implementable.	Low to moderate. Costs for MNR would depend on the time to reach RAOs.	Retained for DAA.
4 – thin-layer capping with ICs	A thin-layer sand cap would be installed over contaminated sediment in the AOEC for physical isolation of contaminated sediment. Thin-layer capping can quickly reduce exposure to contaminants by ecological receptors and requires less infrastructure in terms of material handling, dewatering, treatment, and disposal. ICs would be implemented to ensure that the cap maintained its protectiveness after implementation.	Implementable. Thin-layer capping can be implemented using conventional equipment and locally available materials, and may be implemented more quickly than remedies involving removal and disposal or treatment of sediment.	Moderate capital costs, depending on the surface area and thickness of the capping layer. Cost of ICs could be high, depending on duration.	Retained for DAA.
5 – sediment removal/ dredging	Dredging is a common means of removing contaminated sediment from a water body while it is submerged. It typically necessitates transporting the sediment to a location for treatment and/or disposal. Dredging or a similar sediment removal technology would be effective at reducing COCs at IR Site 24. No ICs would be implemented for this alternative.	Implementable. Implementation of dredging is usually more challenging than MNR or thin-layer capping because of the complex removal technologies themselves and the need for transport, staging, treatment (where applicable), and disposal of the dredged sediment. Because the AOEC is a limited area, disposal capacity is not expected to be a concern. Limited access under the wharf road makes dredging somewhat less implementable than other alternatives.	Moderate to high capital costs based on the limited access in the AOEC. Cost would also be dependent on the sediment and water disposal or treatment requirements.	Retained for DAA.
6 – *in situ* grouting with ICs	Alternative 6 would implement *in situ* grouting to immobilize COCs in the areas where sediment concentrations were reported to be above RAOs. Grouting would be accomplished by adding Portland cement, fly ash, limestone, or other additives to the sediment to encapsulate the contaminants in a solid matrix. The effectiveness of *in situ* grouting is uncertain. This technology has not been implemented on a wide scale. Bench-scale and pilot-scale testing would be needed prior to implementation. Assuming that effective reagents, delivery, and mixing processes could be developed, this alternative should be effective at reducing exposure to COCs by ecological receptors at IR Site 24. A monitoring program and ICs would be implemented to ensure the integrity of the solidified/stabilized treatment area.	Low implementability. Treatment technologies for contaminated sediment frequently offer implementation challenges because of limited full-scale experience and high cost. In addition, the lack of an effective delivery system has also hindered the application of *in situ* grouting. A bench-scale or pilot-scale treatability test would be needed prior to full-scale implementation.	Moderate, depending on the surface area and thickness of the *in situ* grouting layer. Cost of ICs could be high, depending on duration.	Eliminated because *in situ* grouting has uncertain effectiveness, is in the early stages of development, and few delivery methods are currently available commercially.

Acronyms/Abbreviations:
AOEC – area of ecological concern
COC – chemical of concern
DAA – detailed analysis of alternatives
IC – institutional control
IR – Installation Restoration (Program)
MNR – monitored natural recovery
NCP – National Oil and Hazardous Substances Pollution Contingency Plan
RAO – remedial action objective

Table 6-1
Detailed and Comparative Analysis of Sediment Remedial Alternatives by the Balancing Criteria

Alternative	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment	Short-Term Effectiveness	Implementability	Cost*
	Parameters considered: • residual risk at completion • long-term management of remaining contaminants • reliability of engineering controls and ICs • need to replace components • continuing repair/maintenance needs	Parameters considered: • treatment processes • amount of hazardous material • degree of reduction in toxicity, mobility, or volume • degree of irreversibility • treatment residuals	Parameters considered: • short-term risks to community • impacts on workers • environmental impacts • time until protection is achieved	Parameters considered: • technical feasibility • operational reliability • future alternative remedial options • ability to monitor effectiveness • ability to obtain governmental approvals • availability of services and materials	Parameters considered: • net present value • capital costs • O&M costs
2 – ICs	**Low** ICs would be implemented to prohibit disturbance and dispersion of impacted sediment under the wharf road. For cost-estimating purposes, the assumed duration of this alternative is 30 years. The long-term effectiveness of ICs would depend on continued adherence to them.	**Low** The toxicity, mobility, or volume of COCs in sediment would not be reduced under this alternative. This alternative would not include sediment sampling and analysis to provide information about COC concentrations with time.	**Low** ICs implementation would pose no risk to workers, the community, or the environment. ICs could be put in place in a short period of time to prohibit disturbance of sediment in the AOEC. Time until RAOs were achieved would not be known for this alternative.	**High** All activities associated with ICs should be easily implementable.	**High** The present-value cost of this alternative is $426,000, which is lower than Alternatives 3, 4, and 5. Refer to Table 6-2 for a cost summary breakdown of this alternative.
3 – MNR with ICs	**Low** Natural recovery processes would be expected to continue to isolate impacted sediment and reduce COC concentrations in sediment over time. Using a conservative sedimentation rate of one-half the rate at nearby IR Site 17 (Seaplane Lagoon), and an exposure interval of 10 inches, it is conservatively estimated that 10 inches of fresh sediment would be deposited at the site in approximately 33 years. ICs would be implemented to prohibit disturbance and dispersion of impacted sediment under the wharf road. Sediment sampling and analysis, bathymetric surveys, and periodic reviews would be performed to evaluate the sedimentation rate, lines of evidence, and progress of MNR to continue reducing ecological risk. The long-term effectiveness of ICs would depend on continued adherence to them. For cost-estimating purposes, the duration of the MNR program and ICs under Alternative 3 is assumed to be 30 years. The monitoring program and ICs would remain in place until RAOs were achieved and the Navy and regulatory agencies agreed that the site no longer posed potentially unacceptable ecological risk	**Low** The toxicity, mobility, or volume of COCs in sediment would be reduced with time through natural processes; however, no active treatment would be provided by this alternative. This alternative would not include measures to affect the rate at which these natural processes were acting to accomplish ecological risk reduction. Sediment sampling and analysis would provide information to evaluate the reduction in COC concentrations in sediment over time.	**Medium** MNR and ICs implementation would pose minimal risk to workers, the community, and the environment. ICs could be put in place in a short period of time to prohibit disturbance of sediment in the AOEC. Time until protection is achieved for Alternative 3 is assumed to be approximately 30 years, based on a sedimentation rate of 0.3 cm per year. For cost-estimating purposes, the duration of the MNR program and ICs under Alternative 3 is assumed to be 30 years. The estimated sedimentation rate and the resulting time until protection is achieved would be reassessed as part of the 5-year review process and would be based on evaluation of monitoring data collected during the MNR period.	**High** All activities associated with MNR and ICs should be easily implementable.	**Medium** The present-value cost of this alternative is $1,130,000, which is higher than Alternative 2 and lower than Alternatives 4 and 5. Refer to Table 6-3 for a cost summary breakdown for this alternative.

Table 6-1 (continued)

Alternative	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume Through Treatment	Short-Term Effectiveness	Implementability	Cost*
4 – thin-layer capping with ICs	**Medium** Alternative 4 is expected to be an effective means to prevent unacceptable ecological exposure to COCs in sediment. Thin-layer capping and ICs are expected to be reliable in minimizing potential future ecological risks associated with COCs in sediment in the AOEC. ICs would be implemented to prohibit disturbance and dispersion of the cap and impacted sediment under the wharf road. No significant cap maintenance is expected to be necessary after installation of the thin-layer cap. Sediment monitoring and periodic reviews would be performed to confirm the protectiveness of the cap over time. The long-term effectiveness of ICs would depend on continued adherence to them. Alternative 4 assumes that ICs would be implemented for 30 years. ICs would remain in place until RAOs were achieved and the Navy and regulatory agencies agreed that the site no longer posed potentially unacceptable ecological risk.	**Low** Alternative 4 would not reduce toxicity, mobility, or volume through active treatment. However, the mobility of COCs in sediment would be reduced by placement of the cap and, with time, through subsequent sedimentation and passive natural recovery processes. The thin-layer cap included in Alternative 4 would be expected to prevent unacceptable ecological exposure. Sediment sampling and analysis would provide information to evaluate cap performance and the rate of reduction in COC concentrations.	**High** Alternative 4 is considered effective in the short term. It would involve placement of clean sand over impacted sediment at IR Site 24. This operation is expected to take approximately 2.5 months for completion. Once in place, the cap would be expected to effectively prevent unacceptable ecological exposure to underlying impacted sediment. In addition, ICs could be put in place quickly at the site to prevent unacceptable exposure to COCs in sediment. Approximately 50 truckloads of clean sand would be transported to the site. An additional five truck trips would be required for disposal of debris. For this alternative, the benthic habitat in the AOEC would be destroyed when the cap is placed, but it would be expected to be reestablished in the clean backfill sand fairly quickly.	**Medium** Alternative 4 would be moderately implementable because of the limited access and small work areas beneath the wharf road. Placement of thin-layer caps has been performed previously at other sites throughout the United States. Clean cap material is readily available in the San Francisco Bay Area. Sediment sampling and analysis can be performed at the site as demonstrated by previous investigations. Periodic sediment monitoring activities should not be incompatible with the potential reuse options; however, access to the area under the wharf road would need to be maintained to allow for monitoring. Additionally, ICs would be easily implementable at the site.	**Low** The present-value cost of this alternative is $2,047,000, which is higher than Alternatives 2 and 3 and lower than Alternative 5. Refer to Table 6-4 for a cost summary breakdown for this alternative.
5 – sediment removal/ dredging	**High** Alternative 5 is considered to be effective and permanent alternative over the long term, achieving complete removal of sediment containing COC concentrations exceeding preliminary RGs at the AOEC. Once the remedial action was completed, this alternative would eliminate unacceptable exposure to impacted sediment in the AOEC. No ICs or long-term O&M activities would be required under this alternative.	**Medium** Because impacted sediment would be removed and disposed at an off-site disposal facility under Alternative 5, the mass of sediment containing COCs at concentrations exceeding preliminary RGs would be completely removed. Any treatment required to meet land-disposal restrictions would be performed at the disposal facility prior to disposal. This treatment would reduce the toxicity and mobility of chemicals in hazardous sediment prior to disposal. Dredged sediment would not be treated unless required to meet land-disposal restrictions.	**Medium** Under Alternative 5, approximately 65 truck trips through the community would be required for sediment disposal. An additional 70 truck trips would be required for disposal of debris and for importing backfill material. The dredging and off-site disposal operations are expected to take up to 3.5 months for completion. This alternative has the potential to track impacted sediment off-site during transport through the community en route to the disposal facility; potential risks would be mitigated through proper design and implementation of a site-specific safety and health plan and remedial action work plan. For this alternative, the benthic habitat in the AOEC would be destroyed during the removal of impacted sediment in the dredged area, but it would be expected to be reestablished in the clean backfill sand fairly quickly. Dispersion of impacted sediment during dredging operations would be controlled with a silt curtain or screen around the area being dredged.	**Medium** Alternative 5 would be moderately implementable because of the limited access and small work areas under the wharf road. Transportation and off-site disposal of impacted media have been performed in the past at Alameda Point. Disposal facilities in the state of California are capable of accepting the anticipated volumes of dredged sediment and residual wastes.	**Low** The present-value cost of this alternative is $3,324,000, which is higher than Alternatives 2, 3, and 4. Refer to Table 6-5 for a cost summary breakdown for this alternative.

Table 6-1 (continued)

Note:
* cost estimates are based on net present value, where a low cost rating indicates > $2M; a medium cost rating indicates between $1M and $2M; and a high cost rating indicates < $1M

Acronyms/Abbreviations:
AOEC – area of ecological concern
cm – centimeter
COC – chemical of concern
IC – institutional control
IR – Installation Restoration (Program)
MNR – monitored natural recovery
O&M – operation and maintenance
RAO – remedial action objective
RG – remediation goal

Table 6-2
Cost Estimate Summary for Alternative 2: ICs

Description	Capital Cost	Annual Average Cost	Every Fifth Year Cost	Total Cost
Capital Costs				
Remedial design	$50,000			$50,000
Subtotal Capital Costs With Markups[a]				**$50,000**
O&M Costs				
ICs (30 years)		$10,000		$300,000
5-year reviews			$30,000	$150,000
Closeout report				$30,000
Subtotal O&M Costs With Markups[a]				**$480,000**
Subtotal With Markups[a]				**$530,000**
Contingency (20%)				$106,000
TOTAL COST				**$636,000**
Present Value of Alternative 2 (based on 2007 dollars)[b]				**$426,000**

Notes:

[a] markups include general conditions consisting of overall project management, overhead, bonds and insurance, home office support, taxes, and profit

[b] the present value is calculated by adding the capital costs to the present worth of the O&M annual expenditures and periodic costs priced as of January 2007 (including contingency allowances); because the tasks may be completed at different times, the present value was calculated on the basis of real discount rate; for this report, a discount rate of 3.0 percent (OMB 2007) was used

Acronyms/Abbreviations:

IC – institutional control

O&M – operation and maintenance

Table 6-3
Cost Estimate Summary for Alternative 3: MNR With ICs

Description	Capital Cost	Annual Average Cost	Every Fifth Year Cost	Total Cost
Capital Costs				
Predesign work plan and documentation	$50,000			$50,000
Predesign investigation				
Bathymetric survey	$15,000			$15,000
Sampling crew and equipment	$48,000			$48,000
Sediment and surface water sampling	$48,000			$48,000
Waste profile and disposal	$3,000			$3,000
Remedial design	$70,000			$70,000
Subtotal Capital Costs With Markups[a]				**$234,000**
O&M Costs				
Bathymetric survey (every 5 years for 30 years)			$15,000	$90,000
Long-term monitoring (every 5 years for 30 years)			$95,000	$572,000
ICs (30 years)		$10,000		$300,000
5-year reviews			$30,000	$150,000
Closeout report				$30,000
Subtotal O&M Costs With Markups[a]				**$1,142,000**
Subtotal With Markups[a]				**$1,376,000**
Contingency (20%)				$275,000
TOTAL COST				**$1,651,000**
Present Value of Alternative 3 (based on 2007 dollars)[b]				**$1,130,000**

Notes:

[a] markups include general conditions consisting of overall project management, overhead, bonds and insurance, home office support, taxes, and profit

[b] the present value is calculated by adding the capital costs to the present worth of the O&M annual expenditures and periodic costs priced as of January 2007 (including contingency allowances); because the tasks may be completed at different times, the present value was calculated on the basis of real discount rate; for this report, a discount rate of 3.0 percent (OMB 2007) was used

Acronyms/Abbreviations:
IC – institutional control
MNR – monitored natural recovery
O&M – operation and maintenance

Table 6-4
Cost Estimate Summary for Alternative 4: Thin-Layer Capping With ICs

Description	Capital Cost	Annual Average Cost	Every Fifth Year Cost	Total Cost
Capital Costs				
Predesign work plan and documentation	$50,000			$50,000
Predesign investigation				
Utility locating	$12,000			$12,000
Bathymetric survey	$15,000			$15,000
Sampling crew and equipment	$82,000			$82,000
Sediment and surface water sampling	$79,000			$79,000
Waste profile and disposal	$3,000			$3,000
Remedial design	$150,000			$150,000
Thin-layer capping implementation				
Debris removal	$155,000			$155,000
Thin-layer cap installation	$520,000			$520,000
Open water monitoring during construction	$39,000			$39,000
Confirmation sampling	$64,000			$64,000
Bathymetric survey	$15,000			$15,000
Thin-layer capping implementation report	$20,000			$20,000
Subtotal Capital Costs With Markups[a]				**$1,204,000**
O&M Costs				
Bathymetric survey (every 5 years for 30 years)			$15,000	$90,000
Long-term monitoring (every 5 years for 30 years)			$47,000	$285,000
ICs (30 years)		$10,000		$300,000
5-year reviews			$30,000	$150,000
Closeout report				$30,000
Subtotal O&M Costs With Markups[a]				**$855,000**
Subtotal With Markups[a]				**$2,058,000**
Contingency (20%)				$412,000
TOTAL COST				**$2,470,000**
Present Value of Alternative 4 (based on 2007 dollars)[b]				**$2,047,000**

Notes:
[a] markups include general conditions consisting of overall project management, overhead, bonds and insurance, home office support, taxes, and profit
[b] the present value is calculated by adding the capital costs to the present worth of the O&M annual expenditures and periodic costs priced as of January 2007 (including contingency allowances); because the tasks may be completed at different times, the present value was calculated on the basis of real discount rate; for this report, a discount rate of 3.0 percent (OMB 2007) was used

Acronyms/Abbreviations:
IC – institutional control
O&M – operation and maintenance

Table 6-5
Cost Estimate Summary for Alternative 5: Sediment Removal/Dredging

Description	Capital Cost	Annual Average Cost	Every Fifth Year Cost	Total Cost
Capital Costs				
Predesign work plan and documentation	$50,000			$50,000
Predesign investigation				
Utility locating	$12,000			$12,000
Bathymetric survey	$15,000			$15,000
Sampling crew and equipment	$79,000			$79,000
Sediment and surface water sampling	$160,000			$160,000
Waste profile and disposal	$3,000			$3,000
Remedial design	$150,000			$150,000
Sediment removal/dredging implementation				
Debris removal	$155,000			$155,000
Construct/remove stockpile area	$103,000			$103,000
Dredging	$1,366,000			$1,366,000
Open water monitoring during dredging	$35,000			$35,000
Confirmation sampling	$82,000			$82,000
Bathymetric survey	$30,000			$30,000
Stage sediment for disposal	$18,000			$18,000
Waste profile	$10,000			$10,000
Disposal off-site	$235,000			$235,000
Removal and replacement of fender piles, cross members, and utility lines	$285,000			$285,000
Sediment removal/dredging implementation and closeout report	$50,000			$50,000
Subtotal Capital Costs With Markups[a]				**$2,839,000**
Contingency (20%)				$568,000
TOTAL COST				**$3,407,000**
Present Value of Alternative 5 (based on 2007 dollars)[b]				**$3,324,000**

Notes:
[a] markups include general conditions consisting of overall project management, overhead, bonds and insurance, home office support, taxes, and profit
[b] the present value is calculated by adding the capital costs to the present worth of the O&M annual expenditures and periodic costs priced as of January 2007 (including contingency allowances); because the tasks may be completed at different times, the present value was calculated on the basis of real discount rate; for this report, a discount rate of 2.5 percent (OMB 2007) was used

Acronym/Abbreviation:
O&M – operation and management

Table 7-1
Summary of Cost Estimates for IR Site 24 Remedial Alternatives

Alternative	Duration of Alternative	Capital Cost	O&M Cost	Total Cost[a]	Net Present Value[b]
2 – ICs	30 years	$50,000	$480,000	$636,000	$426,000
3 – MNR with ICs	30 years	$234,000	$1,142,000	$1,651,000	$1,130,000
4 – thin-layer capping with ICs	30 years	$1,204,000	$855,000	$2,470,000	$2,047,000
5 – sediment removal/dredging	1 year	$2,839,000	$0	$3,407,000	$3,324,000

Note:
[a] the total cost includes contingency allowances
[b] a discount rate of 3.0 percent per year was used to calculate the net present values for Alternatives 2, 3, and 4, and a discount rate of 2.5 percent per year was used to calculate the net present value for Alternative 5 (OMB 2007)

Acronyms/Abbreviations:
IC – institutional control
IR – Installation Restoration (Program)
MNR – monitored natural recovery
O&M – operation and maintenance

APPENDIX A

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

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TABLES

ATTACHMENTS

Attachment

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ACRONYMS/ABBREVIATIONS

AOEC	area of ecological concern
ARAR	applicable or relevant and appropriate requirement
BAAQMD	Bay Area Air Quality Management District
Basin Plan	Water Quality Control Plan for the San Francisco Bay Basin
BCDC	(San Francisco) Bay Conservation and Development Commission
CAA	Clean Air Act
Cal. Civ. Code	*California Civil Code*
Cal. Code Regs.	*California Code of Regulations*
Cal. Fish & Game Code	*California Fish and Game Code*
Cal. Gov't. Code	*California Government Code*
Cal. Health & Safety Code	*California Health and Safety Code*
Cal. Pub. Res. Code	*California Public Resources Code*
Cal. Water Code	*California Water Code*
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
C.F.R.	*Code of Federal Regulations*
ch.	chapter
CTR	California Toxics Rule
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DDx	the sum of the pesticides dichlorodiphenyltrichloroethane (DDT), dichlorodiphenyldichloroethene (DDE), and dichlorodiphenyldichloroethane (DDD)
div.	division
DoD	Department of Defense
DON	Department of the Navy
DTSC	(California Environmental Protection Agency) Department of Toxic Substances Control
EP	extraction procedure
ESA	Endangered Species Act
Fed. Reg.	*Federal Register*
FS	feasibility study
IC	institutional control
IDW	investigation-derived waste
IR	Installation Restoration (Program)
LDR	land disposal restriction

MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MNR	monitored natural recovery
MOU	memorandum of understanding
NAS	Naval Air Station
NAWQC	National Ambient Water Quality Criteria
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NTR	National Toxics Rule
NWR	National Wildlife Refuge
PCB	polychlorinated biphenyl
pt.	part
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
Res.	resolution
RI	remedial investigation
ROD	record of decision
RWQCB	(California) Regional Water Quality Control Board
§	section
SDWA	Safe Drinking Water Act
SIP	Policy for Implementation of Toxic Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California
STLC	soluble threshold limit concentration
SWRCB	(California) State Water Resources Control Board
TBC	to be considered
TCLP	toxicity characteristic leaching procedure
tit.	title
TSCA	Toxic Substances Control Act
TTLC	total threshold limit concentration
U.S.C.	*United States Code*
U.S. EPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
WET	(California) Waste Extraction Test
WQO	water quality objective

Section A1
INTRODUCTION

This appendix identifies and evaluates potential federal and state of California applicable or relevant and appropriate requirements (ARARs) from the universe of regulations, requirements, and guidance and sets forth the Department of the Navy (DON) determinations regarding those potential ARARs for each response action alternative retained for detailed analysis in this Feasibility Study (FS) Report for Installation Restoration (IR) Program Site 24.

This evaluation includes an initial determination of whether the potential ARARs actually qualify as ARARs and a comparison for stringency between the federal and state regulations to identify the controlling ARARs. The identification of ARARs is an iterative process. The final determination of ARARs will be made by the DON in the record of decision (ROD), after public review, as part of the response action selection process.

A1.1 SUMMARY OF CERCLA AND NCP REQUIREMENTS

Section 121(d) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) (42 *United States Code* [U.S.C.] Section [§] 9621[d]), as amended, states that remedial actions on CERCLA sites must attain (or the decision document must justify the waiver of) any federal or more stringent state environmental standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate.

Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address the situation at a CERCLA site. The requirement is applicable if the jurisdictional prerequisites of the standard show a direct correspondence when objectively compared to the conditions at the site. An applicable federal requirement is an ARAR. An applicable state requirement is an ARAR only if it is more stringent than federal ARARs.

If the requirement is not legally applicable, then the requirement is evaluated to determine whether it is relevant and appropriate. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable, address problems or situations similar to the circumstances of the proposed response action and are well suited to the conditions of the site (U.S. EPA 1988a). A requirement must be determined to be both relevant *and* appropriate to be considered an ARAR.

The criteria for determining relevance and appropriateness are listed in Title (tit.) 40 *Code of Federal Regulations* (C.F.R.) § 300.400(g)(2) and include the following:

- the purpose of both the requirement and the CERCLA action
- the medium regulated or affected by the requirement and the medium contaminated or affected at the CERCLA site
- the substances regulated by the requirement and the substances found at the CERCLA site

- the actions or activities regulated by the requirement and the response action contemplated at the CERCLA site
- any variances, waivers, or exemptions of the requirement and their availability for the circumstances at the CERCLA site
- the type of place regulated and the type of place affected by the release or CERCLA action
- the type and size of structure or facility regulated and the type and size of structure or facility affected by the release or proposed in the CERCLA action
- any consideration of use or potential use of affected resources in the requirement and the use or potential use of the affected resources at the CERCLA site

According to CERCLA ARARs guidance (U.S. EPA 1988a), a requirement may be "applicable" or "relevant and appropriate," but not both. ARARs must be identified on a site-specific basis and involve a two-part analysis: first, a determination whether a given requirement is applicable; then, if it is not applicable, a determination whether it is both relevant and appropriate. It is important to explain that some regulations may be applicable or, if not applicable, may still be relevant and appropriate. When the analysis determines that a requirement is both relevant and appropriate, such a requirement must be complied with to the same degree as if it were applicable (U.S. EPA 1988a).

Tables included in this appendix present each potential ARAR with an initial determination of ARAR status (i.e., applicable, relevant and appropriate, or not an ARAR). For the determination of relevance and appropriateness, the pertinent criteria were examined to determine whether the requirements addressed problems or situations sufficiently similar to the circumstances of the release or response action contemplated, and whether the requirement was well suited to the site. A negative determination of relevance and appropriateness indicates that the requirement did not meet the pertinent criteria. Negative determinations are documented in the tables of this appendix and are discussed in the text only for specific cases.

To qualify as a state ARAR under CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), a state requirement must be:

- a state law or regulation,
- an environmental or facility siting law or regulation,
- promulgated (of general applicability and legally enforceable),
- substantive (not procedural or administrative),
- more stringent than federal requirements,
- identified in a timely manner, and
- consistently applied.

To constitute an ARAR, a requirement must be substantive. Therefore, only the substantive provisions of requirements identified as ARARs in this analysis are considered to be ARARs. Permits are considered to be procedural or administrative requirements. Provisions of generally relevant federal and state statutes and regulations that were determined to be procedural or nonenvironmental, including permit requirements, are not considered to be ARARs. CERCLA Section 121(e)(1), 42 U.S.C. § 9621(e)(1), states, "No Federal, State, or local permit shall be required for the portion of any removal or remedial action conducted entirely on-site, where such remedial action is selected and carried out in compliance with this section." The term *on-site* is defined for purposes of this ARARs discussion as "the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action" (40 C.F.R. § 300.5).

Nonpromulgated advisories or guidance issued by federal or state governments are not legally binding and do not have the status of ARARs. Such requirements may, however, be useful and are "to be considered" (TBC). TBC requirements (40 C.F.R. § 300.400[g][3]) complement ARARs but do not override them. They are useful for guiding decisions regarding cleanup levels or methodologies when regulatory standards are not available.

Pursuant to United States Environmental Protection Agency (U.S. EPA) guidance (U.S. EPA 1988a), ARARs are generally divided into three categories: chemical-, location-, and action-specific requirements. This classification was developed to aid in the identification of ARARs; some ARARs do not fall precisely into one group or another. ARARs are identified on a site basis for remedial actions where CERCLA authority is the basis for cleanup.

As the lead federal agency, the DON has primary responsibility for identifying federal ARARs at IR Site 24. Potential federal ARARs that have been identified for the FS are discussed in Section A1.2.2. Pursuant to the definition of the term *on-site* in 40 C.F.R. § 300.5, the on-site areas that are part of this remedial action are shallow sediments under the wharf road. The area of ecological concern (AOEC) is indicated on Figure 3-1 in the main text of this FS Report.

Identification of potential state ARARs was initiated through DON requests that the California Environmental Protection Agency Department of Toxic Substances Control (DTSC) identify potential state ARARs, an action described in more detail in Section A1.2.3. Potential state ARARs that have been identified for IR Site 24 are discussed below.

A1.2 METHODOLOGY DESCRIPTION

The process of identifying and evaluating potential federal and state ARARs is described in this subsection.

A1.2.1 General

As the lead federal agency, the DON has primary responsibility for identification of potential ARARs for IR Site 24. In preparing this ARARs analysis, the DON undertook the following measures, consistent with CERCLA and the NCP:

- identified federal ARARs for each response action alternative addressed in the main FS Report, taking into account site-specific information for IR Site 24

- reviewed potential ARARs identified by the state to determine whether they satisfy CERCLA and NCP criteria that must be met in order to constitute state ARARs
- evaluated and compared federal ARARs and their state counterparts to determine whether state ARARs are more stringent than the federal ARARs or are in addition to the federally required actions
- reached a conclusion as to which federal and state ARARs are the most stringent and/or "controlling" ARARs for each alternative

As outlined in Section 3 of the main FS Report, the remedial action objectives (RAOs) for IR Site 24 include:

- protection of forage fish from unacceptable contact or ingestion exposure to cadmium in sediment; and
- protection of piscivorous and benthic-feeding birds, including least terns, surf scoters, and double-crested cormorants, from unacceptable exposure to sediment cadmium, lead, total DDx (the sum of the pesticides DDT [dichlorodiphenyltrichloroethane], DDE [dichlorodiphenyldichloroethene], and DDD [dichlorodiphenyldichloroethane]), and total polychlorinated biphenyls (PCBs) through ingestion of contaminated prey.

Remedial action alternatives retained for detailed analysis in this FS Report are designed to accomplish these RAOs. The alternatives for each site use similar technologies to accomplish the goals, but differ in the conceptual approach to their implementation. The IR Site 24 remedial action alternatives for which an ARARs analysis is presented in this appendix are as follows:

- Alternative 1 – no action
- Alternative 2 – institutional controls (ICs)
- Alternative 3 – monitored natural recovery (MNR) with ICs
- Alternative 4 – thin-layer capping with ICs
- Alternative 5 – dredging

A1.2.2 Identifying and Evaluating Federal ARARs

The DON is responsible for identifying federal ARARs as the lead federal agency under CERCLA and the NCP. The final determination of federal ARARs will be made when the DON issues the ROD. The federal government implements a number of federal environmental statutes that are the source of potential federal ARARs, either in the form of the statutes or regulations promulgated thereunder. Examples include the Resource Conservation and Recovery Act (RCRA), the Clean Water Act (CWA), the Safe Drinking Water Act (SDWA), the Toxic Substances Control Act (TSCA), and their implementing regulations. See NCP preamble at 55 *Federal Register* (Fed. Reg.) 8764–8765 (1990) for a more complete listing.

The DON reviewed the proposed response action and alternatives against all potential federal ARARs, including but not limited to those set forth at 55 Fed. Reg. 8764–8765

(1990), in order to determine if they were applicable or relevant and appropriate using the CERCLA and NCP criteria and procedures for ARARs identification by lead federal agencies.

A1.2.3 Identifying and Evaluating State ARARs

The process of identifying and evaluating potential state ARARs by the state and the DON is described in this subsection.

A1.2.3.1 SOLICITATION OF STATE ARARs UNDER NCP

U.S. EPA guidance (U.S. EPA 1988b) recommends that the lead federal agency consult with the state when identifying state ARARs for response actions. In essence, the CERCLA/NCP requirements at 40 C.F.R. § 300.515 for response actions provide that the lead federal agency request that the state identify chemical- and location-specific state ARARs upon completion of site characterization. The requirements also provide that the lead federal agency request identification of all categories of state ARARs (chemical-, location-, and action-specific) upon completion of identification of remedial alternatives for detailed analysis. The state must respond within 30 days of receipt of the lead federal agency requests. The remainder of this subsection documents the DON's efforts to date to identify and evaluate state ARARs.

The DON followed the process set forth in 40 C.F.R. § 300.515 and Section 10.6 of the Federal Facility Agreement for remedial actions for Naval Air Station (NAS) Alameda in seeking state assistance with identification of state ARARs.

A1.2.3.2 CHRONOLOGY OF EFFORTS TO IDENTIFY STATE ARARs

The general process set forth in 40 C.F.R. § 300.515 and the Federal Facility Site Remediation Agreement (SWDIV 2000) for remedial actions was followed in seeking state assistance in identifying state ARARs for remediation at IR Site 24. Key correspondence between the DON and the state agencies relating to this effort is included in the Administrative Record for this FS Report.

In a letter dated September 12, 1996, the DON requested identification of potential state ARARs for the remedial investigation (RI)/FS effort at NAS Alameda. The state of California responded in a DTSC letter to the DON dated November 13, 1996. The response from the DTSC is included as Attachment A1.

The DON submitted an additional request to DTSC in a letter dated November 8, 2007 (Attachment A2) for identification of chemical-, location-, and action-specific ARARs for IR Site 24. The Navy reviewed and identified the state ARARs that apply to IR Site 24 using basewide ARARs that were received from the state in the November 1996 letter (Attachment A1). DTSC has reviewed the IR Site 24 ARARs, and is in agreement with them.

The regulations included in the DTSC responses have been reviewed and those regulations determined to be pertinent to the IR Site 24 remedial alternatives have been included in the ARARs evaluation in the following sections.

A1.3 REQUIREMENTS OF THE FEDERAL RESOURCE CONSERVATION AND RECOVERY ACT

RCRA is a federal statute passed in 1976 to meet four goals: protection of human health and the environment, reduction of waste, conservation of energy and natural resources, and elimination of the generation of hazardous waste as expeditiously as possible. The Hazardous and Solid Waste Amendments of 1984 significantly expanded the scope of RCRA by adding new corrective action requirements, land disposal restrictions (LDRs), and technical requirements. RCRA, as amended, contains several provisions that are potential ARARs for CERCLA sites.

Substantive RCRA requirements are applicable to response actions on CERCLA sites if the waste is a RCRA hazardous waste, and either:

- the waste was initially treated, stored, or disposed after the effective date of the particular RCRA requirement; or
- the activity at the CERCLA site constitutes treatment, storage, or disposal as defined by RCRA (U.S. EPA 1988a).

The preamble to the NCP indicates that state regulations that are components of a federally authorized or delegated state program are generally considered federal requirements and potential federal ARARs for the purposes of ARARs analysis (55 Fed. Reg. 8666, 8742 [1990]). The state of California received approval for its base RCRA hazardous waste management program on July 23, 1992 (57 Fed. Reg. 32726 [1992]). The state of California "Environmental Health Standards for the Management of Hazardous Waste," set forth in *California Code of Regulations* (Cal. Code Regs.) tit. 22, Division (div.) 4.5, were approved by U.S. EPA as a component of the federally authorized state of California RCRA program. On September 26, 2001, California received final authorization of its revised State Hazardous Waste Management Program from U.S. EPA (63 Fed. Reg. 49118 [2001]).

The regulations of Cal. Code Regs. tit. 22, div. 4.5 are therefore a source of potential federal ARARs for CERCLA response actions. The exception is when a state regulation is "broader in scope" than the corresponding federal RCRA regulations. In that case, such regulations are not considered part of the federally authorized program or potential federal ARARs. Instead, they are purely state law requirements and potential state ARARs.

The U.S. EPA notice of July 23, 1992, approving the state of California RCRA program (57 Fed. Reg. 32726 [1992]) specifically indicated that the state regulations addressed certain non-RCRA, state-regulated hazardous wastes that fell outside the scope of federal RCRA requirements. Cal. Code Regs. tit. 22, div. 4.5 requirements would be potential state ARARs for such non-RCRA, state-regulated wastes.

A key threshold question for the ARARs analysis is whether the contaminants at IR Site 24 constitute federal hazardous waste as defined under RCRA and the state's authorized program or whether they qualify as non-RCRA, state-regulated hazardous waste.

A1.4 WASTE CHARACTERIZATION

Selection of ARARs involves the characterization of wastes as described below.

A1.4.1 RCRA Hazardous Waste Determination

A federal RCRA hazardous waste determination is necessary to determine whether a waste is subject to RCRA requirements at Cal. Code Regs. tit. 22, div. 4.5 and other state requirements at Cal. Code Regs. tit. 23, div. 3, Chapter (ch.) 15. The first step in the RCRA hazardous waste characterization process is to evaluate contaminated media at the site and determine whether the contaminant constitutes a "listed" RCRA waste. The preamble to the NCP states that ". . . it is often necessary to know the origin of the waste to determine whether it is a listed waste and that, if such documentation is lacking, the lead agency may assume it is not a listed waste" (55 Fed. Reg. 8666, 8758 [1990]).

This approach is confirmed in U.S. EPA guidance for CERCLA compliance with other laws (U.S. EPA 1988a) as follows.

> To determine whether a waste is a listed waste under RCRA, it is often necessary to know the source. However, at many Superfund sites, no information exists on the source of wastes. The lead agency should use available site information, manifests, storage records, and vouchers in an effort to ascertain the nature of these contaminants. When this documentation is not available, the lead agency may assume that the wastes are not listed RCRA hazardous wastes, unless further analysis or information becomes available that allows the lead agency to determine that the wastes are listed RCRA hazardous wastes.

RCRA hazardous wastes that have been assigned U.S. EPA hazardous waste numbers (or codes) are listed in Cal. Code Regs. tit. 22, § 66261.30–66261.33. The lists include hazardous waste codes beginning with the letters "F," "K," "P," and "U."

Knowledge of the exact source of a waste is required for source-specific listed wastes ("K" waste codes). Some knowledge of the nature or source of the waste is required even for listed wastes from nonspecific sources, such as spent solvents ("F" waste codes) or commercial chemical products ("P" and "U" waste codes). These listed RCRA hazardous wastes are restricted to commercially pure chemicals used in particular processes such as degreasing.

P and U wastes cover only unused and unmixed commercial chemical products, particularly spilled or off-specification products (U.S. EPA 1991a). Not every waste containing a P or U chemical is a hazardous waste. To determine whether a CERCLA investigation-derived waste contains a P or U waste, there must be direct evidence of product use. In particular, all the following criteria must be met. The chemicals must be:

- discarded (as described in 40 C.F.R. § 261.2[a][2]),
- either off-specification commercial products or a commercially sold grade,
- not used (i.e., soil contaminated with spilled unused wastes is a P or U waste), and
- the sole active ingredient in a formulation.

No documentation of past waste disposal practices was found that would serve to classify the sources of sediment contamination at IR Site 24 with respect to the RCRA waste listings. Therefore, the DON has made the determination that the mere presence of listed substances should not classify IR Site 24 sediment as RCRA-listed hazardous wastes. By extension of this reasoning, the residuals generated during sampling or dredging of sediment would not be classified as RCRA-listed hazardous wastes.

The second step in the RCRA hazardous-waste characterization process is to evaluate potential hazardous characteristics of the waste. The evaluation of characteristic waste is described in U.S. EPA guidance as follows (U.S. EPA 1988a).

> Under certain circumstances, although no historical information exists about the waste, it may be possible to identify the waste as RCRA characteristic waste. This is important in the event that (1) remedial alternatives under consideration at the site involve on-site treatment, storage, or disposal, in which case RCRA may be triggered as discussed in this section; or (2) a remedial alternative involves off-site shipment. Since the generator (in this case, the agency or responsible party conducting the Superfund action) is responsible for determining whether the wastes exhibit any of these characteristics (defined in 40 C.F.R. § 261.21–261.24), testing may be required. The lead agency must use best professional judgment to determine, on a site-specific basis, if testing for hazardous characteristics is necessary.
>
> In determining whether to test for the toxicity characteristic using the extraction procedure (EP) toxicity test, it may be possible to assume that certain low concentrations of waste are not toxic. For example, if the total waste concentration in soil is 20 times or less the EP toxicity concentration, the waste cannot be characteristic hazardous waste. In such a case, RCRA requirements would not be applicable. In other instances, where it appears that the substances may be characteristic hazardous waste (ignitable, corrosive, reactive, or EP toxic), testing should be performed.

Hazardous waste characteristics, as defined in 40 C.F.R. § 261.21–261.24, are commonly referred to as ignitability, corrosivity, reactivity, and toxicity. California environmental health standards for the management of hazardous waste set forth in Cal. Code Regs. tit. 22, div. 4.5 were approved by U.S. EPA as a component of the federally authorized California RCRA program. Therefore, the characterization of RCRA waste is based on the state requirements.

The characteristics of ignitability, corrosivity, reactivity, and toxicity are defined in Cal. Code Regs. tit. 22, § 66261.21–66261.24. According to Cal. Code Regs. tit. 22, § 66261.24(a)(1)(A), "A waste that exhibits the characteristic of toxicity pursuant to subsection (a)(1) of this section has the EPA Hazardous Waste Number specified in Table I of this section which corresponds to the toxic contaminant causing it to be hazardous." Table I assigns hazardous waste codes beginning with the letter "D" to wastes that exhibit the characteristic of toxicity; D waste codes are limited to "characteristic" hazardous wastes.

According to Cal. Code Regs. tit. 22, § 66261.10, waste characteristics can be measured by an available standardized test method or be reasonably classified by generators of waste based on their knowledge of the waste, provided that the waste has already been reliably tested or if there is documentation of chemicals used. Sediment at IR Site 24 is not ignitable, corrosive, or reactive, as defined in Cal. Code Regs. tit. 22, § 66261.21–66261.23. This determination is based on the concentrations of contaminants in sediment. For example, none of the identified contaminants could make the sediment ignitable or reactive, and the sediment has been in the water body for decades.

The requirements at Cal. Code Regs. tit. 22, § 66261.24 list the toxic contaminant concentrations that determine the characteristic of toxicity. The concentration limits are in milligrams per liter. These units are directly comparable to total concentrations in waste groundwater and surface water. For waste soils, these concentrations apply to the extract or leachate produced by the toxicity characteristic leaching procedure (TCLP).

A waste is considered hazardous if the contaminants in the wastewater or in the soil TCLP extract equal or exceed the TCLP limits. TCLP testing is required only if total contaminant concentrations in soil equal or exceed 20 times the TCLP limits because TCLP uses a 20-to-1 dilution for the extract (U.S. EPA 1988a).

The maximum concentrations of contaminants in sediment samples at the site were compared to the TCLP limits at Cal. Code Regs. tit. 22, § 66261.24(a)(1). Lead, cadmium, and chromium exceeded 20 times the listed concentrations. Therefore, if sediment waste is generated at the site, it may be determined to be a RCRA hazardous waste, based on the concentrations of these constituents in a TCLP extract, and the TCLP limits at Cal. Code Regs. tit. 22, § 66261.24(a)(1) would be potential ARARs for characterizing waste.

A1.4.2 California-Regulated, Non-RCRA Hazardous Waste

A waste determined not to be a RCRA hazardous waste may still be considered a California-regulated non-RCRA hazardous waste. The state's RCRA program is broader in scope in its hazardous waste determination. Cal. Code Regs. tit. 22, § 66261.24(a)(2) lists the total threshold limit concentrations (TTLCs) and the soluble threshold limit concentrations (STLCs) for non-RCRA hazardous waste. The state applies its own leaching procedure, the Waste Extraction Test (WET), which uses a different acid reagent and has a different dilution factor (tenfold). There are other state requirements that may be broader in scope than federal ARARs for identifying non-RCRA wastes regulated by the state. These may be potential ARARs for wastes not covered under federal ARARs. See additional subsections of Cal. Code Regs. tit. 22, § 66261.24. A waste is considered hazardous if its total concentrations exceed the TTLCs or if the extract concentrations from the WET exceed the STLCs. A WET is required when the total concentrations exceed the STLC but are less than the TTLCs (Cal. Code Regs. tit. 22, div. 4.5, ch. 11, Appendix II [b]).

Maximum detected concentrations of cadmium and lead exceeded the TTLC limits. Maximum detected concentrations of cadmium, lead, and silver also exceeded 10 times the STLC. Therefore, if the sediment were removed, it might be determined to be a non-RCRA hazardous waste based on the toxicity characteristic.

If sediment waste is generated, the STLCs and TTLCs for the potential chemicals of concern at Cal. Code Regs. tit. 22, § 66261.24(a)(2) may be potential ARARs for characterizing waste.

A1.4.3 Other California Waste Classifications

For waste discharged after July 18, 1997, solid waste classifications at Cal. Code Regs. tit. 27, §§ 20210, 20220, and 20230 are used to determine applicability of waste management requirements. These are summarized below.

A "designated waste" under Cal. Code Regs. tit. 27, § 20210 is defined at *California Water Code* (Cal. Water Code) § 13173. Under Cal. Water Code § 13173, designated waste is hazardous waste that has been granted a variance from hazardous waste management requirements or nonhazardous waste that consists of or contains pollutants that, under ambient environmental conditions at a waste management unit, could be released in concentrations exceeding applicable water quality objectives (WQOs) or that could reasonably be expected to affect beneficial uses of the waters of the state.

A nonhazardous solid waste under Cal. Code Regs. tit. 27, § 20220 is all putrescible and nonputrescible solid, semisolid, and liquid wastes, including garbage, trash, refuse, paper, rubbish, ashes, industrial wastes, demolition and construction wastes, abandoned vehicles and parts thereof, discarded home and industrial appliances, manure, vegetable or animal solid and semisolid wastes, and other discarded waste (whether of solid or semisolid consistency), provided that such wastes do not contain wastes that must be managed as hazardous wastes or wastes that contain soluble pollutants in concentrations that exceed applicable WQOs or could cause degradation of waters of the state.

Under Cal. Code Regs. tit. 27, § 20230, inert waste is that subset of solid waste that does not contain hazardous waste or soluble pollutants at concentrations in excess of applicable WQOs and does not contain significant quantities of decomposable waste.

If sediment is removed from the AOEC at IR Site 24, waste definitions at Cal. Code Regs. tit. 27, §§ 20210, 20220, and 20230 may be potential ARARs for waste characterization.

Section A2
CHEMICAL-SPECIFIC ARARs

Chemical-specific ARARs are generally health- or risk-based numerical values or methodologies applied to site-specific conditions that result in the establishment of a cleanup level. Many potential ARARs associated with particular response alternatives (such as closure or discharge) can be characterized as action-specific but include numerical values or methodologies to establish them so they fit in both categories (chemical- and action-specific). To simplify the comparison of numerical values, most action-specific requirements that include numerical values are included in this chemical-specific section and, if repeated in the action-specific section, the discussion refers back to this section.

This section presents the ARARs determination conclusions addressing numerical values for sediment and a summary of the potential ARARs followed by a more detailed discussion. Since the remedial alternatives include activities that could affect the surface water and air, ARARs for surface water and air are also included. Groundwater is not a medium of concern at the site and the remedial action alternatives would not pose a threat to groundwater.

Potential federal and state chemical-specific ARARs are summarized in Tables A2-1 and A2-2, respectively, at the end of this appendix.

A2.1 SUMMARY OF ARARs CONCLUSIONS BY MEDIUM

Sediment is the medium of concern for IR Site 24. Surface water may also be affected by the IR Site 24 remedial action alternatives. The conclusions for ARARs pertaining to these media are presented in the following sections.

A2.1.1 Sediment ARARs Conclusions

Chemicals of concern at IR Site 24 include cadmium, lead, total DDx, and total PCBs. No chemical-specific ARARs have been identified for the cleanup levels for sediment at IR Site 24. The sediment cleanup levels are based on risk to ecological receptors. However, because the sediment could be hazardous waste if removed, the substantive provisions of the hazardous waste characterization limits listed below have been identified as potentially applicable ARARs:

- RCRA hazardous waste definition at Cal. Code Regs. tit. 22, § 66261.21, 66261.23, 66261.24(a)(1), and 66261.100 for characterizing waste prior to disposal
- state definitions of waste at Cal. Code Regs. tit. 27, §§ 20210, 20220(a), and 20230(a) and the definitions of state regulated non-RCRA hazardous waste at Cal. Code Regs. tit. 22, § 66261.3(a)(2)(C) or 66261.3(a)(2)(F), 66261.22(a)(3) and (4), 66261.24(a)(2)–(a)(8), and 66261.101 for characterizing sediment prior to off-site disposal

The substantive provisions at 40 C.F.R. § 761.61(c)(2), which require that the risk-based sampling, cleanup, and disposal of PCBs should not pose an unreasonable risk to human health or the environment, are potential ARARs for this remedial action, which includes sampling, cleanup, and disposal.

Table A2-3 lists the potential state and federal hazardous waste limits for the detected chemicals in sediment that, if the sediment were removed, could exceed hazardous waste levels at IR Site 24.

A2.1.2 Surface Water ARARs Conclusions

Surface water has not been identified as a medium of concern for IR Site 24, and no remedial action has been identified as necessary for surface water at the site. However, remedial action for sediment at IR Site 24 may result in a discharge to surface water. Therefore, chemical-specific ARARs have been identified for surface water. Substantive provisions of the following requirements are potential ARARs for the IR Site 24 remedial action:

- water quality standards at 40 C.F.R. § 131.36(b) and 131.38 for dewatering effluent discharge to surface water
- National Ambient Water Quality Criteria for cadmium, specifically 33 U.S.C. ch. 26, § 1314(a) and 42 U.S.C. ch. 103, § 9621(d)(2)
- Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan); Chapter 2, Beneficial Uses designated for IR Site 24; and Chapter 3, WQOs for turbidity and suspended sediment with the exception of nuisance (to protect beneficial uses)
- State Water Resources Control Board (SWRCB) Resolution (Res.) No. 68-16 for new discharges associated with dredging and dewatering effluent. SWRCB Res. No. 68-16 is not a chemical-specific ARAR for setting sediment cleanup levels (see below for DON and state positions and agreement on Res. 68-16)
- Policy for Implementation of Toxic Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (SIP), Sections 1.3 and 1.4 for dewatering effluent discharge to the bay; not an ARAR for setting sediment cleanup levels or dredging discharges (see below for DON and state positions and agreement on the SIP)

A2.1.3 Air ARARs Conclusions

Although air is not a medium of concern for IR Site 24, one of the alternatives could potentially result in dust emissions. Sediment handling after removal/dredging may cause dust emissions. Therefore, the Bay Area Air Quality Management District (BAAQMD) Rules 6-1-301, 11-1-301, and 11-1-302 are potentially applicable federal ARARs for potential dust emissions resulting from handling of dredged sediment prior to off-site disposal.

A2.2 DETAILED DISCUSSION OF ARARs BY MEDIUM

The following subsections provide a detailed discussion of federal and state ARARs by medium.

A2.2.1 Sediment ARARs

The following chemicals in surface sediment are addressed by this FS Report: cadmium, lead, total PCBs, and total DDx. Any historical releases to sediment likely occurred several decades ago and do not currently pose a continuing risk of a new release to sediment or surface water. Groundwater and surface water are not media of concern for IR Site 24; alternatives considered in this FS Report are intended to address sediment in the AOEC only.

A2.2.1.1 FEDERAL ARARs

In this subsection, potential federal chemical-specific ARARs for sediment are evaluated.

RCRA Hazardous Waste

The federal RCRA requirements at 40 C.F.R. part (pt.) 261 do not apply in California because the state RCRA program is authorized. The authorized state RCRA requirements are therefore considered potential federal ARARs (Section A1.3). The applicability of RCRA requirements depends on whether the waste is a RCRA hazardous waste; whether the waste was initially treated, stored, or disposed after the effective date of the particular RCRA requirement; and whether the activity at the site constitutes treatment, storage, or disposal as defined by RCRA. However, RCRA requirements may be relevant and appropriate even if they are not applicable. Examples include activities that are similar to those defined as RCRA treatment, storage, or disposal for waste that is similar to RCRA hazardous waste.

The determination of whether a waste is a RCRA hazardous waste can be made by comparing the site waste to the definition of RCRA hazardous waste. Substantive RCRA requirements at Cal. Code Regs. tit. 22, § 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100 are potential federal ARARs because they define RCRA hazardous waste. A waste can meet the definition of hazardous waste if it has the toxicity characteristic of hazardous waste. This determination is made by using the TCLP. The maximum concentrations allowable for the TCLP listed in Cal. Code Regs. tit. 22, § 66261.24(a)(1)(B) are potential federal ARARs for determining whether the waste is hazardous. If the site waste has concentrations exceeding these values, it is determined to be a characteristic RCRA hazardous waste (Section A1.4). RCRA hazardous waste definitions at Cal. Code Regs. tit. 22, § 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100 are potentially applicable for characterizing waste generated prior to off-site disposal.

Toxic Substances Control Act

TSCA regulates the storage and disposal of PCBs. These requirements have both action- and chemical-specific aspects and address storage and disposal activities for PCBs. Therefore, they may be discussed in both this section and Section A4. Under TSCA, U.S. EPA has promulgated 40 C.F.R. § 761.61 PCB remediation waste requirements that provide cleanup and disposal options for PCB remediation waste. The options include: 1) self-implementing on-site cleanup and disposal, 2) performance-based disposal, and 3) risk-based disposal. The self-implementing cleanup provisions are not binding on cleanups conducted under other authorities, including actions conducted under Sections 104 or 106 of CERCLA. Therefore, they are not applicable ARARs for actions at CERCLA sites. However, in the preamble of the final rule for 40 C.F.R. pt. 761, U.S. EPA indicated that it anticipates that the final rule "will be a potential ARAR at CERCLA sites where PCBs are present." U.S. EPA expects that "CERCLA cleanups would typically comply with the substantive requirements of one of the three options, provided by § 761.61, upon completion of the cleanups" (63 Fed. Reg. 35407 [1998]).

The requirements at 40 C.F.R. § 761.61(c) for risk-based disposal are mostly procedural, requiring U.S. EPA approvals. The substantive provisions are at § 761.61(c)(2), which requires that risk-based sampling, cleanup, and disposal not pose an unreasonable risk of injury to health or the environment. Therefore, substantive provisions at 40 C.F.R. § 761.61(c)(2) are potentially relevant and appropriate for the remedial action alternatives that include sampling, cleanup, and disposal.

A2.2.1.2 STATE ARARs

State RCRA requirements included in the U.S. EPA-authorized RCRA program for California are considered to be potential federal ARARs and are therefore discussed in the previous section. When state regulations are either broader in scope or more stringent than their federal counterparts, they are considered potential state ARARs. State requirements such as the non-RCRA, state-regulated hazardous waste requirements may be potential state ARARs because they are not within the scope of the federal ARARs (57 Fed. Reg. 60848). The Cal. Code Regs. tit. 22, div. 4.5 requirements that are part of the state-approved RCRA program would be potential state ARARs for non-RCRA, state-regulated hazardous wastes. Substantive provisions of Cal. Code Regs. tit. 22, § 66261.3(a)(2)(C) or 66261.3(a)(2)(F), 66261.22(a)(3) and (4), 66261.24(a)(2)–(a)(8), and 66261.101 are potentially applicable for characterizing waste generated during the remedial action.

Waste definitions at Cal. Code Regs. tit. 27, §§ 20210, 20220, and 20230 are potential ARARs for characterizing waste generated during the remedial action.

A2.2.2 Surface Water ARARs

Discharge to surface water incidental to the remedial alternative actions is included as an element of IR Site 24 ARARs evaluation. Potential federal and state ARARs for surface water are detailed in the following subsections.

A2.2.2.1 FEDERAL ARARs

Federal requirements evaluated as potential ARARs for surface water are discussed below.

Water Quality Standards

On December 22, 1992, U.S. EPA promulgated federal water quality standards under the authority of the federal CWA Section 303(c)(4)(B), 33 U.S.C., ch. 26, § 1313, in order to establish water quality standards required by the CWA where the state of California and other states had failed to do so (57 Fed. Reg. 60848 [1992]). These standards have been amended over the years in the *Federal Register* including the amendments of the National Toxics Rule (NTR) (60 Fed. Reg. 22228 [1995]). The water quality standards, as amended, are codified at 40 C.F.R. § 131.36. The water quality standards contained in 40 C.F.R. § 131.36(b) are potential applicable federal ARARs for discharge to surface water.

U.S. EPA promulgated a rule on May 18, 2000, to fill a gap in California's water quality standards. The gap was created in 1994 when a state court overturned the state's water quality control plans that contained water quality criteria for priority toxic pollutants. The rule, commonly called the California Toxics Rule (CTR), is codified at 40 C.F.R. § 131.38. These federal criteria are legally applicable in the state of California for inland surface waters and enclosed bays and estuaries for all purposes and programs under the CWA.

These standards of the CTR apply to the state's designated uses and "supersede any criteria adopted by the State, except when State regulations contain criteria which are more stringent for a particular use in which case the State's criteria will continue to apply."

National Ambient Water Quality Criteria

Section 304(a)(1) of the CWA (33 U.S.C. § 1314[a][1]) directs U.S. EPA to publish and periodically update ambient water quality criteria. The National Ambient Water Quality Criteria (NAWQC) are updated in the *Federal Register*. The latest list of the NAWQC through June 2000 was published in the *Federal Register* on December 10, 1998, with amendments in 64 Fed. Reg. 19781 (1999). If criteria are not listed for a pollutant, U.S. EPA does not have any national recommended water quality criteria.

These criteria reflect the latest scientific knowledge on the identifiable effects of pollutants on public health and welfare, aquatic life, and recreation. These criteria serve as guidance to states in adopting water quality standards under Section 303(c) of the CWA that protect human life and aquatic life from acute and chronic effects.

NAWQC may be potentially relevant and appropriate for surface water, depending on the designated use and whether the criteria are intended to be protective of that use. NAWQC may be used to establish cleanup goals for surface water that is considered a potential source of drinking water only in the absence of promulgated maximum contaminant levels (MCLs) or maximum contaminant level goals (MCLGs). However, if the surface water's designated beneficial use requires protection of aquatic life, the NAWQC may be more stringent than the MCL, MCLG, or other cleanup standard for non–drinking water sources and the more stringent standard would be the controlling ARAR.

The current NAWQC for cadmium is more stringent than the CTR for cadmium. Therefore, NAWQC for cadmium, specifically 33 U.S.C. ch. 26, § 1314(a) and 42 U.S.C. ch. 103, § 9621(d)(2), are potential relevant and appropriate requirements for surface water for potential discharges during dredging.

A2.2.2.2 STATE ARARs

State requirements evaluated as potential ARARs for surface water are discussed in the subsections below.

Water Quality Control Plan for the San Francisco Bay Basin

The substantive provisions of the Basin Plan for the San Francisco Bay Basin (RWQCB 1995) at Chapter 2 for beneficial uses and Chapter 3 for WQOs are potential state ARARs for discharges to surface water, as discussed below.

IR Site 24 is located in the San Francisco Bay in the lower portion of the South Bay Basin. The designated beneficial uses for the lower San Francisco Bay include:

- industrial service supply;
- ocean, commercial, and sport fishing;
- shellfish harvesting;
- estuarine habitat;
- fish migration;
- preservation of rare and endangered species;
- wildlife habitat;
- water contact recreation;
- nonwater-contact recreation; and
- navigation.

The WQOs for turbidity and suspended sediment with the exception of nuisance (to protect beneficial uses) are potentially applicable requirements for expected discharges to surface waters during remediation activities. The Basin Plan has a WQO for cadmium, but this WQO is not more stringent than the NAWQC identified as a federal ARAR and, therefore, is not a potential ARAR.

Inland Surface Waters Plan/Enclosed Bays and Estuaries Plan

The Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays and Estuaries of California (SWRCB 2005), which is Phase 1 of the SIP, was effective on April 28, 2000, with respect to the priority pollutant criteria promulgated for California by U.S. EPA through the NTR (40 C.F.R. § 131.36) and to the priority pollutant objectives established by the Regional Water Quality Control Boards (RWQCBs) in their water quality control plans (basin plans). The Inland Surface Waters Plan was effective on May 18, 2000, with respect to the priority pollutant criteria promulgated by U.S. EPA through the CTR (40 C.F.R. § 131.38). The Inland Surface Waters Plan implements the federal numeric water quality criteria (40 C.F.R. § 131.36 and 131.38) by requiring that they serve as the basis for determining water-quality-based effluent limitations for point sources that protect beneficial uses.

The determination of whether an effluent limitation is required is based on whether the point-source discharge may cause, have a reasonable potential to cause, or contribute to an excursion above any applicable priority pollutant criterion or WQO. If an effluent limitation is required, it can be calculated using the appropriate dilution credit and ambient background concentration for the site or it could be based on the total maximum daily load if one is in effect.

The state asserts that the SIP is applicable for setting sediment cleanup levels. The substantive requirements for determining whether an effluent limitation is required and the methodology for calculating the effluent limitation found in Sections 1.3 and 1.4 of the Inland Surface Waters Plan are potentially applicable state ARARs for discharges that cause, have a reasonable potential to cause, or contribute to an excursion above an applicable priority pollutant criterion or objective into inland surface waters, and enclosed bays and estuaries (nonocean surface waters). Because the Inland Surface Waters Plan is intended to apply to calculating effluent limits for point-source discharges only, it is not a potential ARAR for nonpoint-source discharges of contaminants to surface waters, such as the discharge from sediment excavation activities. With respect to nonpoint sources, the policy states that only Section 5.1 applies. This section is not substantive and is not a potential ARAR. However, removal of sediments from IR Site 24 will comply with the intent of the SWRCB policy for nonpoint-source discharges to have self-implemented management practices through the implementation of engineering controls.

State Water Resources Control Board Res. 92-49 and 68-16

The DON and the state of California have not agreed on whether SWRCB Res. 92-49 and 68-16 are ARARs for the remedial action at IR Site 24. Therefore, this FS Report documents each party's position but does not attempt to resolve the issue.

SWRCB Res. 92-49 (as amended on April 21, 1994, and October 2, 1996) is entitled Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Cal. Water Code § 13304. This resolution contains policies and procedures for the regional boards that apply to all investigations and cleanup and abatement activities for all types of discharges subject to Cal. Water Code § 13304.

SWRCB Res. 68-16, Statement of Policy With Respect to Maintaining High Quality of Waters in California, establishes the policy that high-quality waters of the state "shall be maintained to the maximum extent possible" consistent with the "maximum benefit to the people of the state." It provides that whenever the existing quality of water is better than the required applicable water quality policies, such existing high-quality water will be maintained until it has been demonstrated to the state that any change will be consistent with maximum benefit to the people of the state, will not unreasonably affect present and anticipated beneficial use of such water, and will not result in water quality less than that prescribed in the policies. It also states that any activity that produces or may produce a waste or increased volume or concentration of waste and that discharges or proposes to discharge to existing high-quality waters will be required to meet waste discharge requirements that will result in the best practicable treatment or control of the discharge necessary to assure that 1) pollution or a nuisance will not occur and 2) the highest water quality consistent with maximum benefit to the people of the state will be maintained (SWRCB 1968).

Cleanup to below background water quality conditions is not required by the SWRCB under the Porter-Cologne Water Quality Control Act. SWRCB Res. 92-49 II.F.1 (SWRCB 1992) provides that regional boards may require cleanup and abatement to "conform to the provisions of the Resolution No. 68-16 of the SWRCB, and the Water Quality Control Plans of the State and Regional Water Quality Control Boards, provided that under no circumstances shall these provisions be interpreted to require cleanup and abatement which achieves water quality conditions that are better than background conditions."

DON's Position Regarding SWRCB Res. 92-49 and 68-16. The DON has determined that SWRCB Res. 68-16 is not a chemical-specific ARAR for determining remedial action goals for IR Site 24 sediment. However, SWRCB Res. 68-16 is a potential action-specific ARAR for regulating new discharges such as discharges to surface water during dredging and dewatering activities. The DON has determined that further migration of already contaminated sediment is not a discharge governed by the language in Res. 68-16. More specifically, the language of SWRCB Res. 68-16 indicates that it is prospective in intent, applying to new discharges in order to maintain existing high-quality waters. It is not intended to apply to restoration of waters that are already degraded.

The substantive provisions of SWRCB Res. 92-49 at Section III.G state that the RWQCB shall "ensure that dischargers are required to clean up and abate the effects of discharges in a manner that promotes attainment of either background water quality, or the best water quality which is reasonable, if background levels of water quality cannot be restored." Surface water is not a medium of concern addressed by this remedial action for the sediments of IR Site 24. Therefore, Res. 92-49 is not a potential ARAR; however, the cleanup goals agreed to by the DON and regulatory agencies, including the RWQCB, are consistent with the requirements of SWRCB Res. 92-49.

State of California's Position Regarding SWRCB Res. 92-49 and 68-16. The state does not agree with the DON determination that SWRCB Res. 92-49 and 68-16 are not ARARs for this remedial action. SWRCB has interpreted the term "discharges" in the Cal. Water Code to include the movement of waste from soils to groundwater and from contaminated to uncontaminated water (SWRCB 1994). The RWQCB asserts that SWRCB Res. 68-16 and 92-49 are ARARs for determining sediment cleanup levels. However, the state agrees that the remedial action would comply with SWRCB Res. 92-49 and 68-16. Whereas the DON and the state of California have not agreed on whether SWRCB Res. 92-49 and 68-16 are ARARs for this response action, this FS Report documents each party's position on the resolutions but does not attempt to resolve the issue.

A2.2.3 Air ARARs

Although air is not a medium of concern for IR Site 24, there is a potential for dust emissions for the sediment removal/dredging alternative. The handling of sediment after removal/dredging could result in dust emissions. The sediment will be allowed to drain over the water where it was removed until the sediment is nonflowing. Then, it will be placed on-site in a staging pile prior to off-site disposal. It is unlikely that the sediment will dry completely enough to be susceptible to wind erosion or result in dust emissions. However, the following air requirements for emissions were identified as potential ARARs for potential dust emissions.

Substantive requirements of the BAAQMD rules that have been approved by U.S. EPA as part of the State Implementation Plan under the Clean Air Act (CAA) are potential federal ARARs for air emissions (CAA Section 110). Visible emission requirements at BAAQMD Rule 6-1-301 are potentially applicable federal ARARs because they are part of the State Implementation Plan. As part of the State Implementation Plan, the requirements at BAAQMD 11-1-301 and 11-1-302 are potentially applicable federal ARARs because the sediment has elevated lead concentrations. The concentrations of lead in the sediment are not expected to be high enough to exceed the regulated levels in these requirements. The wet sediment is not expected to be held on-site long enough to allow the sediment to dry and become a threat to exceed these emission standards. If sediment becomes dry before off-site disposal, the soil will be sprayed with water as necessary to prevent dust emissions.

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Section A3
LOCATION-SPECIFIC ARARs

Potential location-specific ARARs are identified and discussed in this section. The discussions are presented based on various attributes of the site location, such as whether it is within a floodplain. Additional surveys will be performed in connection with the response action design and implementation to confirm location-specific ARARs where inadequate siting information currently exists, or in the event of changes to planned facility locations.

A3.1 SUMMARY OF LOCATION-SPECIFIC ARARs

Biological resources and coastal resources are the resource categories relating to location-specific requirements potentially affected by the IR Site 24 remedial action alternatives. There are no known or suspected cultural resources, wetlands or floodplains resources, or hydrological or geological resources at IR Site 24. The conclusions for ARARs pertaining to biological and coastal resources are presented in the following sections.

A3.1.1 Biological Resources Conclusions

The substantive provisions of the Endangered Species Act (ESA) of 1973 at 16 U.S.C. § 1536(a) and (h)(1)(B) are ARARs because a federal endangered species (California least tern) may use IR Site 24 as a foraging area. Because migratory birds are known to occur at Alameda Point, substantive provisions of the Migratory Bird Treaty Act at 16 U.S.C. § 703 were also identified as potential ARARs.

Because IR Site 24 is located in the San Francisco Bay, the remedial action may potentially affect marine mammals. Therefore, the substantive provisions of the Marine Mammal Protection Act at 16 U.S.C. § 1372(a)(2) were identified as potential ARARs.

A3.1.2 Coastal Resources Conclusions

The Coastal Zone Management Act (CZMA) was evaluated and certain substantive provisions at 16 U.S.C. § 1456(c) were determined to be relevant and appropriate federal requirements because the remedial alternatives considered in this FS Report contemplate activity within the coastal zone. CZMA at 16 U.S.C. § 1456(c)(1)(A) requires each federal agency activity within or outside the coastal zone that affects any land or water use or natural resource to conduct its activities in a manner that is consistent to the maximum extent practicable with enforceable policies of approved state management policies. The state of California's approved coastal management program includes the McAteer-Petris Act, the authorizing legislation for the San Francisco Bay Plan, developed by the Bay Conservation and Development Commission (BCDC). Substantive provisions of the McAteer-Petris Act at *California Government Code* (Cal. Gov't. Code), tit. 7.2 §§ 66600–66661 and the San Francisco Bay Plan at Cal. Code Regs. tit. 14, §§ 10110–11990 are potential state ARARs. Under Cal. Gov't. Code, tit. 7.2, § 66610(b), the jurisdiction of the BCDC is a shoreline band 100 feet inland of and parallel to the shoreline.

A3.1.3 Hydrologic Resources Conclusions

The substantive provisions of the Fish and Wildlife Coordination Act at 16 U.S.C. § 662 have been determined to be a potentially applicable ARAR for the alternatives that include dredging and filling that could potentially affect fish and wildlife. The remedial action would be designed to prevent loss of or damage to fish and wildlife.

A3.2 DETAILED DISCUSSION OF ARARs

The following subsections provide a detailed discussion of potential federal and state ARARs by location-specific resources. Pertinent and substantive provisions of the potential ARARs listed and described below were reviewed to determine whether they are potential federal or state ARARs for sediment at IR Site 24.

Requirements that are determined to be potential ARARs are identified in Table A3-1 (federal) and Table A3-2 (state) at the end of this appendix. ARARs determinations are presented in the column with the heading "ARAR Determination." Determinations of status for location-specific ARARs were generally based on maps or lists included in the regulation or prepared by the administering agency. References to the document or agency consulted are provided in the "Comments" column and may be provided in footnotes to the table. Specific issues concerning some of the requirements are discussed in the following sections.

A3.2.1 Biological Resources ARARs

IR Site 24 is part of a large base in the coastal zone that has some protected wildlife. The following requirements were evaluated to determine potential ARAR status:

- ESA of 1973 (substantive provisions of 16 U.S.C. §§ 1531–1543)
- Migratory Bird Treaty Act of 1972 (substantive provisions of 16 U.S.C. §§ 703–712)
- Marine Mammal Protection Act (substantive provisions of 16 U.S.C. §§ 1361–1421h)
- Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §§ 1801–1882)
- National Wildlife Refuge System Administration Act of 1996 (16 U.S.C. § 668dd–668ee and substantive provisions of 50 C.F.R. § 27.11–27.97)
- Wilderness Act (16 U.S.C. §§ 1131–1136 and 50 C.F.R. § 35.1–35.14)
- California ESA (California Fish and Game Code [Cal. Fish & Game Code], ch. 1.5, §§ 2050–2116)

A3.2.1.1 FEDERAL ARARs

Federal requirements evaluated as potential ARARs for biological resources are discussed in the subsections below.

Endangered Species Act of 1973

The ESA of 1973 (16 U.S.C. §§ 1531–1543) provides a means for conserving various species of fish, wildlife, and plants that are threatened with extinction. The ESA defines an endangered species and provides for the designation of critical habitats. Federal agencies may not jeopardize the continued existence of any listed species or cause the destruction or adverse modification of critical habitat. Under Section 7(a) of the ESA (16 U.S.C. § 1536[a][2]), federal agencies must carry out conservation programs for listed species. The Endangered Species Committee may grant an exemption for agency action if reasonable mitigation and enhancement measures such as propagation, transplantation, and habitat acquisition and improvement are implemented (16 U.S.C. § 1536[h][1][B]). Consultation regulations at 50 C.F.R. pt. 402 are administrative in nature and are therefore not ARARs. However, they may be guidance to comply with the substantive provisions of the ESA.

Based on the Biological Assessment for Disposal and Reuse of NAS Alameda and Fleet and Industrial Supply Center, Alameda Facility and Annex, Alameda, California, dated September 1997 (Tetra Tech, Inc. 1997), the California least tern habitat is present at IR Site 2 and the offshore areas (including IR Site 24). The California least tern is a federal endangered species listed at 50 C.F.R. § 17.11, and is also a state endangered species listed at Cal. Code Regs. tit. 14, § 670.5. The substantive provisions of the ESA of 1973 at 16 U.S.C. § 1536(a) and (h)(1)(B) are potential ARARs because a federal endangered species (California least tern) can use IR Site 24 as a forage area.

Migratory Bird Treaty Act of 1972

The Migratory Bird Treaty Act (16 U.S.C. §§ 703–712) prohibits at any time, using any means or manner, the pursuit, hunting, capturing, and killing or attempting to take, capture, or kill any migratory bird. This act also prohibits the possession, sale, export, and import of any migratory bird or any part of a migratory bird, as well as nests and eggs. A list of migratory birds for which this requirement applies is found at 50 C.F.R. § 10.13. It is the DON's position that this act is not legally applicable to DON actions; however, Executive Order Number 13186 (dated January 10, 2001) requires each federal agency taking actions that have or are likely to have a measurable effect on migratory bird populations to develop and implement, within 2 years, a memorandum of understanding (MOU) with the United States Fish and Wildlife Service (USFWS) to promote the conservation of such populations. The Department of Defense (DoD) recently signed (July 2006) an MOU with the USFWS. The MOU will be evaluated when a remedial action is necessary. The MOU describes the responsibilities of the DoD with respect to conservation of migratory birds for all DoD activities, including "hazardous waste cleanup." The Migratory Bird Treaty Act will continue to be evaluated as a potentially relevant and appropriate requirement for DON CERCLA response actions.

The substantive provisions of the Migratory Bird Treaty Act at 16 U.S.C. § 703 are potential ARARs because migratory birds are present on NAS Alameda and may pass through IR Site 24. The DON has concluded that the remedial action alternatives considered for IR Site 24 will not adversely affect any migratory birds.

Marine Mammal Protection Act

The Marine Mammal Protection Act (16 U.S.C. §§ 1361–1421h) prohibits the taking of a marine mammal on the high seas or in a harbor or other place under the jurisdiction of the United States. It prohibits the possession, transport, and sale of a mammal or marine mammal product, unless authorized under law. Because marine mammals are known to be present near IR Site 24, substantive provisions of the Marine Mammal Protection Act are potentially applicable ARARs. The prohibitions at 16 U.S.C. § 1372(a)(2) are potentially applicable to IR Site 24 remedial action alternatives. The sediment sampling and dredging and capping activities would be implemented in a manner that would protect marine mammals.

Magnuson-Stevens Fishery Conservation and Management Act of 1976, as Amended

The purpose of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §§ 1801–1882) is to conserve and manage the fishery resources found off the coasts of the United States, the anadromous species, and the continental shelf fishery resources of the United States. It establishes a fishery conservation zone within which the United States has exclusive fishery management prerogatives. This is not an ARAR for IR Site 24, since there are no managed fisheries at the site.

National Wildlife Refuge System Administration Act of 1966

The National Wildlife Refuge (NWR) System Administration Act of 1966 (16 U.S.C. § 668dd–668ee) and its implementing regulations at 50 C.F.R. pts. 25–37 establish wildlife refuges that are maintained for the primary purpose of developing a national program of wildlife and ecological conservation and rehabilitation. These refuges are established for the restoration, preservation, development, and management of wildlife and wild land habitats; protection and preservation of endangered or threatened species and their habitats; and management of wildlife and wild lands to obtain the maximum benefit from these resources.

The NWR System Administration Act contains the following substantive requirements that were evaluated for potential ARAR status. The act prohibits any person from disturbing, injuring, cutting, burning, removing, destroying, or possessing any property within any area of a wildlife refuge. The act also prohibits the taking or possessing of any fish, bird, mammal, or other wild vertebrate or invertebrate animals or nest or eggs within any refuge area or otherwise occupying any such area unless such activities are done with a permit or permitted by express provision of law. The act also regulates the use of audio equipment as well as motorized vehicles, aircraft, and boats in wildlife refuges. It prohibits construction activities, disposal of waste, and the introduction of plants and animals into any wildlife refuge. The prohibitions under the act are codified at 50 C.F.R. pt. 27. These requirements are not ARARs for IR Site 24 since there is no wildlife refuge at the site.

Wilderness Act

The Wilderness Act (16 U.S.C. § 1131) and its accompanying implementing regulations (50 C.F.R. § 35.1–35.14) create the National Wilderness Preservation System. The intent of the law is to administer and manage units of this system (i.e., wilderness areas) in order to preserve their wilderness character and to leave them unimpaired for future use as wilderness. These are not ARARs for IR Site 24 since there are no wilderness areas at the site.

A3.2.1.2 STATE ARARs

General sections of the Cal. Fish & Game Code were evaluated for potential ARARs. Requirements of some sections of the California ESA were identified as potential ARARs.

The California ESA is codified in the Cal. Fish & Game Code §§ 2050–2116. It is the DON's position that the requisite federal sovereign immunity waiver does not exist to authorize applicability of the California ESA. Nevertheless, this act will be evaluated as a potentially relevant and appropriate requirement for the DON's CERCLA response actions. Cal. Fish & Game Code § 2080 prohibits the take of endangered species.

Based on the Biological Assessment for Disposal and Reuse of NAS Alameda and Fleet and Industrial Supply Center, Alameda Facility and Annex, Alameda, California, dated September 1997 (Tetra Tech, Inc. 1997), the California least tern habitat is present at IR Site 2 and offshore areas (including IR Site 24). The California least tern is a federal endangered species listed at 50 C.F.R. § 17.11, and is a state endangered species listed at Cal. Code Regs. tit. 14, § 670.5. Since the state ESA is not more stringent than the federal ESA identified above as an ARAR, these requirements are not potential ARARs for this remedial action.

A3.2.2 Coastal Resources ARARs

The portion of IR Site 24 addressed by this remedial action is sediment under water within the coastal zone. The following requirements were evaluated as potential ARARs:

- CZMA (substantive provisions of 16 U.S.C. §§ 1451–1464, 15 C.F.R. pt. 930)
- California Coastal Act of 1976 (*California Public Resources Code* [Cal. Pub. Res. Code] §§ 30000–30900; Cal. Code Regs. tit. 14, §§ 13001–13666.4)
- McAteer-Petris Act (Cal. Gov't. Code §§ 66600–66661)
- San Francisco Bay Plan (Cal. Code Regs. tit. 14, §§ 10110–11990)

A3.2.2.1 FEDERAL ARARs

The CZMA (16 U.S.C. §§ 1451–1464) specifically excludes federal lands from the coastal zone (16 U.S.C. § 1453[1]). Therefore, the CZMA is not potentially applicable to IR Site 24. The substantive provisions of 16 U.S.C. § 1456(c) are potentially relevant and appropriate because IR Site 24 is near the coast. CZMA at 16 U.S.C. § 1456(c)(1)(A) requires each federal agency activity within or outside the coastal zone that affects any land or water use or natural resource to conduct its activities in a manner that is consistent to the maximum extent practicable with enforceable policies of approved state management policies. A state coastal zone management program is developed under state law guided by the CZMA and its accompanying implementing regulations in 15 C.F.R. pt. 930. A state program sets forth objectives, policies, and standards to guide public and private uses of lands and water in the coastal zone. See Section A3.2.2.2 for the state coastal zone management program.

A3.2.2.2 STATE ARARs

State requirements evaluated as potential ARARs for coastal resources are discussed in the subsections below.

California Coastal Act of 1976

The California Coastal Act of 1976 is codified at Cal. Pub. Res. Code §§ 30000–30900 and Cal. Code Regs. tit. 14, §§ 13001–13666.4. These sections regulate activities associated with development to control direct significant impacts on coastal waters and to protect state and national interests in California coastal resources. However, Cal. Pub. Res. Code § 30103 specifically excludes the areas under the jurisdiction of the BCDC, established pursuant to the McAteer-Petris Act at Cal. Gov't. Code tit. 7.2, commencing with § 66600. Under Cal. Gov't. Code tit. 7.2, § 66610(b), the jurisdiction of the BCDC is a shoreline band 100 feet inland of and parallel to the shoreline. IR Site 24 is within the area of jurisdiction under the San Francisco Bay Plan. Therefore, the California Coastal Act of 1976 is not a potential ARAR for IR Site 24.

McAteer-Petris Act and the San Francisco Bay Plan

The DON has identified the substantive provisions of the following requirements as state location-specific ARARs:

- McAteer-Petris Act (Cal. Gov't. Code tit. 7.2, §§ 66600–66661 as authorizing legislation for the San Francisco Bay Plan)
- San Francisco Bay Plan at Cal. Code Regs. tit. 14, §§ 10110–11990 regulating activities that affect the San Francisco Bay

The state of California's approved coastal management program includes the McAteer-Petris Act, the authorizing legislation for the San Francisco Bay Plan, developed by the BCDC. Substantive provisions of this statute and plan are potential state ARARs. The remedial action alternatives of this FS Report will be completed in a manner consistent with the substantive provisions of the San Francisco Bay Plan, which include limitations on filling the bay, promoting public access, regulating development, and minimization of harmful effects on the bay.

A3.2.3 Hydrologic Resources ARARs

A federal hydrologic ARAR for IR Site 24 is discussed below. No state hydrologic ARARs exist for this site.

The Fish and Wildlife Coordination Act (16 U.S.C. §§ 661–666c) was enacted to protect fish and wildlife when federal actions result in the control or structural modification of a natural stream or body of water. The statute requires federal agencies to take into consideration the effect a water-related project would have on fish and wildlife and take action to prevent loss or damage to these resources. The substantive provisions at

16 U.S.C. § 662 have been determined to be a potentially applicable ARAR for the alternatives that include dredging and filling that could potentially affect fish and wildlife. The remedial action would be designed to prevent loss of or damage to fish and wildlife.

Section 10 of the Rivers and Harbors Act of 1899 prohibits the creation of any obstruction not authorized by Congress to the navigable capacity of any of the waters of the United States (33 U.S.C. §§ 401–413). It prohibits construction of wharves, piers, booms, weirs, breakwaters, bulkheads, jetties, or other structures in a port unless the construction is approved by the United States Army Corps of Engineers. In addition, excavation or filling of any port, harbor, channel, lake, or any navigable water is prohibited without authorization. Section 10 permits are required for these activities. Section 10 permits cover construction, excavation, or deposition of materials in, over, or under navigable waters, or any work that would affect the course, location, condition, or capacity of those waters. The substantive provisions of the Rivers and Harbors Act were determined not to be ARARs for the proposed alternatives since they do not involve the regulated activities. See Section A4 and Table A4-1 for additional information regarding dredging and filling requirements.

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Section A4
ACTION-SPECIFIC ARARs

This section evaluates action-specific ARARs for remedial action alternatives at IR Site 24. Detailed descriptions of the remedial alternatives are provided in the main text of this FS Report. This ARARs analysis is based on the following alternatives evaluated for the site:

- Alternative 1 – no action
- Alternative 2 – ICs
- Alternative 3 – MNR with ICs
- Alternative 4 – thin-layer capping with ICs
- Alternative 5 – sediment removal/dredging

Tables A4-1 and A4-2 at the end of this appendix present and evaluate federal and state potential action-specific ARARs for IR Site 24, respectively. This section presents discussion of the requirements determined to be pertinent to each alternative being evaluated for remedial action at IR Site 24.

A4.1 ALTERNATIVE 1 – NO ACTION

There is no need to identify ARARs for the no action alternative because ARARs apply to "any removal or remedial action conducted entirely on-site" and "no action" is not a removal or remedial action (CERCLA Section 121[e], 42 U.S.C. § 9621[e]). CERCLA Section 121 (42 U.S.C. § 9621) cleanup standards for selection of a Superfund remedy, including the requirement to meet ARARs, are not triggered by the no action alternative (U.S. EPA 1991b). Therefore, a discussion of compliance with action-specific ARARs is not appropriate for this alternative.

A4.2 ALTERNATIVE 2 – ICs

For Alternative 2, ICs would be put in place at IR Site 24 to prevent contaminated sediment from being disbursed into the open water area by:

- prohibiting disturbance of sediments in the AOEC under the wharf road and
- prohibiting removal of the wharf road (including a land-use restriction/structure maintenance agreement).

No federal action-specific ARARs were identified for ICs.

State statutes that have been accepted by the DON as ARARs for implementing ICs and entering into an Environmental Restriction Covenant and Agreement with DTSC include substantive provisions of the *California Civil Code* (Cal. Civ. Code) § 1471 and *California Health and Safety Code* (Cal. Health & Safety Code) §§ 25202.5, 25222.1, 25232(b)(1)(A)–(E), 25233(c), 25234, and 25355.5. DTSC promulgated a regulation on April 19, 2003, regarding the Requirements for Land Use Covenants at Cal. Code Regs. tit. 22, § 67391.1. The substantive provisions of this regulation have been determined to be relevant and appropriate state ARARs by the DON.

The substantive provisions of Cal. Civ. Code § 1471 are the following general narrative standard: ". . . to do or refrain from doing some act on his or her own land . . . where . . . : (c) Each such act relates to the use of land and each such act is reasonably necessary to protect present or future human health or safety or the environment as a result of the presence on the land of hazardous materials, as defined in Section 25260 of the Health and Safety Code." This narrative standard would be implemented through incorporation of restrictive environmental covenants in the deed at the time of transfer. These covenants would be recorded with the environmental restriction covenant and agreement and run with the land.

The substantive provisions of Cal. Health & Safety Code § 25202.5 are the general narrative standard to restrict "present and future uses of all or part of the land on which the . . . facility . . . is located . . . ." These substantive provisions would be implemented by incorporation of restrictive environmental covenants in the Environmental Restriction Covenant and Agreement at the time of transfer for purposes of protecting present and future public health and safety.

Actual land-use restriction requirements are set forth in Cal. Health & Safety Code § 25232(b)(1)(A)–(E). These include prohibitions on construction of residences, hospitals for humans, schools for persons under 21 years of age, day care centers, or any permanently occupied human habitation on hazardous waste property. Cal. Health & Safety Code § 25233(c) sets forth substantive criteria for granting variances from the uses prohibited in Cal. Health & Safety Code § 25232(b)(1)(A)–(E), based on specified environmental and health criteria.

Cal. Health & Safety Code §§ 25222.1 and 25355.5(a)(1)(C) provide the authority for the state to enter into voluntary agreements to establish land-use covenants with the owner of property. The substantive requirements of the following Cal. Health & Safety Code § 25222.1 provisions are relevant and appropriate: (1) the general narrative standard: "restricting specified uses of the property, . . ." and (2) ". . . the agreement is irrevocable, and shall be recorded by the owner, . . . as a hazardous waste easement, covenant, restriction or servitude, or any combination thereof, as appropriate, upon the present and future uses of the land." The substantive requirements of the following Cal. Health & Safety Code § 25355.5(a)(1)(C) provisions are also relevant and appropriate: ". . . execution and recording of a written instrument that imposes an easement, covenant, restriction, or servitude, or combination thereof, as appropriate, upon the present and future uses of the land." The DON would comply with the substantive requirements of Cal. Health & Safety Code §§ 25222.1 and 25355.5(a)(1)(C) by incorporating the CERCLA use restrictions into the DON's deed of conveyance in the form of restrictive covenants under the authority of Cal. Civ. Code § 1471 and into the environmental restriction covenant and agreement. The substantive provisions of Cal. Health & Safety Code §§ 25222.1 and 25355.5(a)(1)(C) may be interpreted in a manner that is consistent with the substantive provisions of Cal. Civ. Code § 1471. The covenants would be recorded with the deed and run with the land.

Cal. Health & Safety Code § 25233(c) sets forth relevant and appropriate substantive criteria for granting variances from prohibited uses based upon specified environmental and health criteria. Cal. Health & Safety Code § 25234 sets forth the following relevant and appropriate substantive criteria for the removal of a land-use restriction on the grounds that "... the waste no longer creates a significant existing or potential hazard to present or future public health or safety."

In addition to being implemented through the Environmental Restriction Covenant and Agreement between the DON and DTSC, the appropriate and relevant portions of Cal. Health & Safety Code §§ 25202.5, 25222.1, 25233(c), 25234, and 25355.5(a)(1)(C) and Cal. Civ. Code § 1471 would also be implemented through the deed between the DON and the transferee.

U.S. EPA agrees that the substantive portions of the state statutes and regulations referenced in this section are ARARs. U.S. EPA specifically considers (a)(1), (a)(2), (d), (e)(1), and (e)(2) of Cal. Code Regs. tit. 22, § 67391.1, to be relevant and appropriate. DTSC's position is that all the state statutes and regulations referenced in this section are ARARs.

A4.3 ALTERNATIVE 3 – MNR WITH ICs

This alternative includes the same potential ARARs for ICs as those identified for Alternative 2. In addition, this alternative includes sampling of the sediment to monitor the natural recovery of the sediment. The monitoring would be conducted to measure the progress of the site in attaining risk-based remedial goals. No ARARs were identified for monitoring the sediment. The sampling activities would generate investigation-derived waste (IDW) (U.S. EPA 1991a). The IDW would be temporarily stored on-site, characterized, and disposed off-site. Potential ARARs were identified for handling the IDW.

The substantive RCRA on-site waste generation and characterization requirements at Cal. Code Regs. tit. 22, §§ 66262.10(a), 66262.11, and 66264.13(a) and (b) were identified as potentially applicable ARARs for characterizing waste prior to off-site disposal. Any waste generated during MNR would be placed in containers. The waste would be handled based on sediment sampling results. The substantive provisions of the following RCRA storage and handling requirements are potentially applicable ARARs for this alternative because RI results indicate that sediment contaminant levels could exceed hazardous waste levels:

- Cal. Code Regs. tit. 22, § 66262.34 for accumulating waste
- Cal. Code Regs. tit. 22, § 66264.171, .172, .173, .174, .175(a) and (b), .177, and .178 for container storage
- Cal. Code Regs. tit. 22, § 66264.553 (b), (d), (e), and (f) for temporary unit alternatives for containers

No additional state requirements for monitoring sediment or storing or characterizing waste were identified as ARARs. The waste would be characterized using the state chemical-specific ARARs identified in Section A2.2.1.2.

A4.4 ALTERNATIVE 4 – THIN-LAYER CAPPING WITH ICs

Alternative 4 includes the sampling of sediment prior to placement of the cap. Potential ARARs associated with ICs and management of IDW from the monitoring activities are the same as those identified under Alternative 3.

The thin-layer cap material (clean, washed sand) is considered fill material, as defined by 33 C.F.R. § 323.2(e)(1). Placement of a cap has the same effect as replacing a portion of water with dry land or changing the bottom elevation of any portion of a water of the United States. Discharge of fill material is defined at 33 C.F.R. § 323.2(f) and includes the placement of fill material that is necessary for the construction of any structure or infrastructure. Therefore, substantive provisions of the following requirements regarding discharge of fill material were identified as potential federal ARARs for placement of the thin-layer cap:

- 33 C.F.R. § 320.4 (general policies for evaluating permit applications)
- 40 C.F.R. § 230.10 (restrictions on discharge) and 230.11 (factual determinations)
- 40 C.F.R. § 230.20–230.25 (potential impacts on physical and chemical characteristics of the aquatic ecosystem such as substrate, suspended particulate/turbidity, water, current patterns and water circulation, normal water fluctuations, and salinity gradients)
- 40 C.F.R. § 230.31 and 230.32 (potential impacts on biological characteristics of the aquatic ecosystem such as fish, crustaceans, mollusks, and other aquatic organisms in the food web; and other wildlife)
- 40 C.F.R. § 230.53 (potential effects on human-use characteristics, such as aesthetics)

No state ARARs were identified specifically for the thin-layer cap. The state requirements reviewed included the Basin Plan. However, there were no substantive requirements identified that were more stringent than federal requirements identified as ARARs above. The same potential state ARARs for storage and characterization of IDW prior to off-site disposal for Alternative 3 are potential ARARs for this alternative.

A4.5 ALTERNATIVE 5 – SEDIMENT REMOVAL/DREDGING

Alternative 5 would employ dredging or a similar technology to remove sediment with contaminant concentrations that exceed remedial action goals. Sediment would be disposed off-site at approved upland disposal facilities. The removed sediment would be placed on a barge and dewatered in the vicinity of the AOEC, with water allowed to flow back to the general area where it was dredged. Once the dredged material is nonflowing waste, it would be moved to land nearby and stored in staging piles prior to off-site disposal. The waste would be characterized prior to off-site disposal, either by sampling prior to dredging or sampling after the waste is dewatered. Once the sediment in the AOEC is dredged, the removed sediment would be backfilled with clean sand.

A4.5.1 Federal ARARs

Upon review of 33 C.F.R. § 320 and 40 C.F.R. § 230, it was determined that the definition for discharge of dredged material does not include incidental fallback (33 C.F.R. § 323.2[d][3]). Incidental fallback is the redeposit of small volumes of dredged material that is incidental to excavation activity in waters of the United States when such material falls back to substantially the place as the initial removal. Examples of incidental fallback include soil that is disturbed when dirt is shoveled and the back-spill that comes off a bucket when such small volume of soil or dirt falls into substantially the same place from which it was initially removed. The term "discharge of dredged material" does not include discharges of pollutants into waters of the United States resulting from the onshore subsequent processing of dredged material that is extracted for any commercial use (other than fill) nor incidental fallback (33 C.F.R. § 323.2[d][3][i] and [ii]). Since the dredging operations are not expected to result in a discharge of dredged material under the regulatory definitions, the regulations governing the discharge of dredged and fill material regulations are not determined to be potential ARARs for the dredging operations.

The dredged material would be dewatered over water. Once it is not flowing, the dredged material would be placed on land in staging piles. When placed on land to further dry out, sediment would be stockpiled on bermed and lined stockpile areas prior to off-site disposal. The soil would be managed in accordance with the following federal and state requirements, depending on the nature of the contamination and whether the soil was classified as RCRA or non-RCRA hazardous waste. It is anticipated that the excavated soil would consist of some RCRA hazardous and/or non-RCRA hazardous waste, due to elevated concentrations of metals. Where possible, the two waste types would be segregated.

If, based on representative sampling and analysis of each stockpile, soil excavated from the area was determined to be RCRA hazardous waste, then the substantive provisions of the amended RCRA staging pile regulations (effective April 22, 2002) would be potentially applicable. These regulations consist of the performance and technical standards for staging piles (40 C.F.R. § 264.554[d][1][i–ii] and [d][2]); staging-pile requirements for reactive, ignitable, and incompatible wastes (§ 264.554[e–f]); and closure requirements for staging piles (§ 264.554[j]–[k]). A staging pile may be designated for temporary (up to 2 years or more based on the necessity to assure timely and efficient implementation of remedial actions [§ 264.554{i}{2}]) treatment or storage of solid, nonflowing remediation waste. The RCRA LDRs, the landfill minimum technology requirements, and the waste-pile permitting requirements are not applicable to staging piles for RCRA hazardous wastes.

The staging-pile regulations also require that the unit facilitate a remedy that is reliable, effective, and protective (40 C.F.R. § 264.554[d][1][i]), and be designed using appropriate measures (e.g., liners, covers, run-on/runoff controls) to prevent or minimize releases and cross-media transfers of hazardous wastes and constituents (40 C.F.R. § 264.554[d][1][ii]). For units located in a previously contaminated area of the facility, all remediation wastes, contaminated containment system components, structures, and equipment that are contaminated with waste or leachate must be removed or decontaminated within 180 days after the operating term of the staging pile expires (40 C.F.R. § 264.554[j]). In addition, contaminated subsoils must be decontaminated. For units located on uncontaminated areas of the facility, within 180 days following expiration of the operating term, the staging pile must be closed in accordance with waste-pile closure requirements at Cal. Code Regs. tit. 22, § 66264.258(a) and the closure performance standards at Cal. Code Regs. tit. 22, § 66264.111 for permitted facilities (40 C.F.R. § 264.554[k]).

If the waste is determined not to be a RCRA hazardous waste, further evaluation of the criteria to determine whether the requirements are relevant and appropriate is necessary. The wastes and proposed actions are similar to those addressed by the RCRA staging-pile requirements. Using the pertinent NCP criteria listed in 40 C.F.R. § 300.400(g)(2) (the substances and media at the site are the same or similar to those addressed by the RCRA requirements), the media and the proposed action are the same as those addressed by RCRA. Therefore, the 40 C.F.R. § 264.554(d)(1)(i–ii) and (d)(2), (e), (f), (h), (i), (j), and (k) requirements are potentially relevant and appropriate even if they are determined not to be applicable.

The same ARARs identified for waste characterization for Alternative 3 are also ARARs for this alternative.

The backfill is considered fill material as defined by 33 C.F.R. § 323.2(e)(1), like the materials used for the thin-layer cap for Alternative 4. The same ARARs identified for discharge of dredged or fill material for the thin-layer cap are ARARs for placing the backfill for this alternative.

A4.5.2 State ARARs

No state ARARs were identified for dredging. The same state requirements identified as ARARs for waste characterization prior to off-site disposal as those in Alternative 3 are ARARs for this alternative.

Section A5
REFERENCES

California State Water Resources Control Board. 1968. Resolution No. 68-16. Statement of Policy With Respect to Maintaining High Quality Waters in California.

———. 1992. Resolution No. 92-49 (as amended on 21 April 1994 and 02 October 1996): Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304.

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———. 2005. Policy of Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (Phase 1 of the Inland Surface Waters Plan and the Enclosed Bays and Estuaries Plan.

California Regional Water Quality Control Board. 1995. Water Quality Control Plan, San Francisco Bay Basin. San Francisco Bay RWQCB. June.

RWQCB. *See* California Regional Water Quality Control Board.

SWDIV. *See* United States Navy, Southwest Division.

SWRCB. *See* California State Water Resources Control Board.

Tetra Tech, Inc. 1997. Biological Assessment for Disposal and Reuse of NAS Alameda and Fleet and Industrial Supply Center, Alameda Facility and Annex, Alameda, California. September.

United States Environmental Protection Agency. 1988a. CERCLA Compliance With Other Laws Manual, Draft Guidance. EPA/540/G-89/006. Office of Emergency and Remedial Response, Washington, DC. August.

———. 1988b. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. OSWER Directive 9355.3-01, -02. EPA/540/G-89/004. October.

———. 1991a. Management of Investigation-Derived Wastes During Site Inspections. EPA/540/G-91/009. May.

———. 1991b. ARARs Q's and A's: General Policy, RCRA, CWA, SDWA, Post-ROD Information, and Contingent Waivers. OSWER Directive No. 9234.2-01/FS-A. Washington, DC. June.

United States Navy, Southwest Division. 2000. Federal Facility Site Remediation Agreement.

U.S. EPA. *See* United States Environmental Protection Agency.

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TABLES

Table A2-1
Potential Federal Chemical-Specific[a] ARARs by Medium

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
SEDIMENT				
Resource Conservation and Recovery Act (42 U.S.C. ch. 82, §§ 6901–6991[i])[c]				
Defines RCRA hazardous waste.	Waste	Cal. Code Regs. tit. 22, § 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100	Applicable	Wastes generated during the remedial action will be characterized prior to disposal off-site.
Risk-based sampling, cleanup, and disposal will not pose an unreasonable risk of injury to health or the environment.	PCBs are present	40 C.F.R. § 761.61(c)(2)	Relevant and appropriate	Substantive provisions are potentially relevant and appropriate for the remedial action alternatives that include sampling, cleanup, and disposal.
SURFACE WATER				
Clean Water Act of 1977, as Amended (33 U.S.C. Chapter 26, §§ 1251–1387)[c]				
Water Quality Standards, National Toxics Rule, and California Toxics Standards	Discharges to waters of the United States	40 C.F.R. § 131.36(b) and 131.38	Applicable	Potentially applicable to the discharge to surface water expected during dredging. Not an ARAR for cleanup of site because surface water is not a medium of concern for this FS Report.
National Ambient Water Quality Criteria	Discharges to waters of the United States	33 U.S.C. ch. 26, § 1314(a) and 42 U.S.C., ch. 103, § 9621(d)(2)	Relevant and appropriate	Potentially relevant and appropriate for cadmium for the discharge to surface water expected during dredging. Not an ARAR for cleanup of site since surface water is not a medium of concern for this FS Report.

Table A2-1 (continued)

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
		AIR		
Clean Air Act (42 U.S.C. §§ 7401–7671)[c]				
A person shall not emit from any source for a period or periods aggregating more than 3 minutes in any hour a visible emission which is as dark as or darker than No. 1 on the Ringelmann Chart or of such opacity as to obscure an observer's view to an equivalent or greater degree.	Dust emissions	BAAQMD Regulation 6-1-301	Applicable	Substantive provisions are applicable for handling sediment prior to transportation off site.
A person shall not discharge any emission of lead, or compound of lead calculated as lead, from any emission point in excess of 6.75 kilograms (15 pounds) per day.	Dust emissions	BAAQMD Rule 11-1-301	Applicable	Substantive provisions are applicable for handling sediment prior to transportation off site.
A person shall not discharge any emission of lead, or compound of lead calculated as lead, that will result in ground level concentrations in excess of 1.0 $\mu g/m^3$ averaged over 24 hours.	Dust emissions	BAAQMD Rule 11-1-302	Applicable	Substantive provisions are applicable for handling sediment prior to transportation off site.

Notes:

[a] many potential action-specific ARARs contain chemical-specific limitations and are addressed in the action-specific ARAR tables

[b] only the substantive provisions of the requirements cited in this table are potential ARARs

[c] statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the statutes or policies in their entirety as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only pertinent substantive requirements of the specific citations are considered potential ARARs

Table A2-1 (continued)

Acronyms/Abbreviations:

ARAR – applicable or relevant and appropriate requirement
BAAQMD – Bay Area Air Quality Management District
Cal. Code Regs. – *California Code of Regulations*
C.F.R. – *Code of Federal Regulations*
ch. – chapter
DON – Department of the Navy
FS – feasibility study
$\mu g/m^3$ – micrograms per cubic meter
PCB – polychlorinated biphenyl
RCRA – Resource Conservation and Recovery Act
§ – section
tit. – title
U.S.C. – *United States Code*

Table A2-2
Potential State Chemical-Specific[a] ARARs by Medium

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
SEDIMENT				
California Environmental Protection Agency Department of Toxic Substances Control[c]				
Definitions of designated waste, nonhazardous waste, and inert waste.		Cal. Code Regs. tit. 27, §§ 20210, 20220(a), and 20230(a)	Applicable	Potentially applicable for characterizing dredged sediment and sediment sampling waste. Not an ARAR for setting sediment cleanup levels.
Definition of "non-RCRA hazardous waste."	Waste	Cal. Code Regs. tit. 22, § 66261.3(a)(2)(C) or 66261.3(a)(2)(F), 66261.22(a)(3) and (4), 66261.24(a)(2)–(a)(8), 66261.101	Applicable	Potentially applicable for determining whether dredged sediment and sampling waste is a non-RCRA hazardous waste.
SURFACE WATER				
State Water Quality Control Board and Regional Water Quality Control Board[c]				
Describes the water basins in San Francisco Bay, establishes beneficial uses of groundwater and surface water, establishes water quality objectives, including narrative and numerical standards, establishes implementation plans to meet water quality objectives and protect beneficial uses, and incorporates statewide water quality control plans and policies.		Comprehensive Water Quality Control Plan for the San Francisco Bay (Basin Plan) (Cal. Water Code § 13240) Chapter 2, Beneficial Uses, for San Francisco Bay Lower Chapter 3, Water Quality Objectives, for turbidity and suspended sediment with the exception of nuisance	Applicable	Substantive requirements pertaining to beneficial uses for surface water at IR Site 24 and water quality objectives for turbidity and suspended sediment with the exception of nuisance are potentially applicable for surface water during dredging activities. Not an ARAR for the sediment cleanup because the surface water is not a medium of concern for this FS Report.

Table A2-2 (continued)

Requirement	Prerequisite	Citation[b]	ARAR Determination	Comments
Establishes the policy that high-quality waters of the state "shall be maintained to the maximum extent possible" consistent with the "maximum benefit to the people of the State." Provides that when existing quality of water is better than required by applicable water quality policies, the existing high-quality water will be maintained until it is demonstrated that any change will be consistent with maximum benefit to the people of the state, will not unreasonably affect beneficial use of such water, and will not result in water quality less than that prescribed in the policies. States that any activity that produces or may produce a waste or increased volume or concentration of waste and that discharges or proposes to discharge to existing high-quality waters will be required to meet waste-discharge requirements that will result in the best practicable treatment or control of the discharge.		Statement of Policy With Respect to Maintaining High Quality of Waters in California, SWRCB Res. 68-16	Applicable	Substantive requirements are potentially applicable for surface water during dredging activities. Not an ARAR for the cleanup of the site because surface water is not a medium of concern for this FS Report. See Section A2.2.2 for discussion of Navy and state positions and agreement regarding this requirement.
Describes requirements for RWQCB oversight of investigation and cleanup and abatement activities resulting from discharges of hazardous substances. RWQCB may decide on cleanup and abatement goals and objectives for the protection of water quality and beneficial uses of water within each region. Establishes criteria for "containment zones" where cleanup to established water-quality goals is not economically or technically practicable.		Policies and procedures for investigation and cleanup and abatement of discharges under Cal. Water Code § 13304, SWRCB Res. 92-49	Not an ARAR	Not an ARAR for sediment cleanup. See Section A2.2.2 for discussion of Navy and State positions and agreement regarding this requirement.
Requires analysis for each priority pollutant to determine if water-quality-based effluent limitation is required. Provides effluent limitation development methodology.	Discharges of toxic priority pollutants into inland surface waters, bays, or estuaries.	Policy for Implementation of Toxic Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (Inland Surface Waters Plan), Sections 1.3 and 1.4	Not an ARAR	Not a potential ARAR for nonpoint sources such as discharge during dredging. Not an ARAR for setting sediment cleanup levels. The state disagrees. See Section A2.2.2 for a discussion of Navy and state positions and agreement regarding this requirement.

Table A2-2 (continued)

Notes:

[a] many potential action-specific ARARs contain chemical-specific limitations and are addressed in the action-specific ARAR tables

[b] only the substantive provisions of the requirement(s) cited in this table are potential ARARs

[c] statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the statutes or policies in their entirety as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only pertinent substantive requirements of the specific citations are considered potential ARARs

Acronyms/Abbreviations:

ARAR – applicable or relevant and appropriate requirement
Basin Plan – Water Quality Control Plan for the San Francisco Bay Basin
Cal. Code Regs. – *California Code of Regulations*
Cal. Water Code – *California Water Code*
DON – Department of the Navy
FS – feasibility study
IR – Installation Restoration (Program)
RCRA – Resource Conservation and Recovery Act
Res. – resolution
RWQCB – (California) Regional Water Quality Control Board
§ – section
SWRCB – (California) State Water Resources Control Board
tit. – title

Table A2-3
Hazardous Waste Criteria for Maximum Detected Concentrations of Chemicals in Sediment

Analyte	TCLP[a] (mg/L in extract)	TTLC[b] (mg/kg in waste)	STLC[c] (mg/L in extract)
cadmium	1	100	1
chromium	5	500	5
lead	5	1,000	5
silver	5	500	5

Notes:
[a] maximum concentrations at Cal. Code Regs. tit. 22, § 66261.24(a)(1)(B)
[b] Cal. Code Regs. tit. 22, § 66261.24(a)(2)(A)
[c] Cal. Code Regs. tit. 22, § 66261.24(a)(2)(B)

Acronyms/Abbreviations:
Cal. Code Regs. – *California Code of Regulations*
mg/kg – milligrams per kilogram
mg/L – milligrams per liter
§ – section
STLC – soluble threshold limit concentration
TCLP – toxicity characteristic leaching procedure
tit. – title
TTLC – total threshold limit concentration

Table A3-1
Potential Federal Location-Specific ARARs

Location	Requirement	Prerequisite	Citation[a]	ARAR Determination	Comments
National Historic Preservation Act of 1966, as Amended (16 U.S.C. § 470–470x-6)[b]					
Historic project owned or controlled by federal agency	Action to preserve historic properties; planning of action to minimize harm to properties listed on or eligible for listing on the National Register of Historic Places.	Property included in or eligible for the National Register of Historic Places.	16 U.S.C. § 470–470x-6 36 C.F.R. pt. 800 40 C.F.R. § 6.301(b)	Not an ARAR	There are no known or suspected historical resources in the sediment at IR Site 24. The floating USS Hornet Museum will not be potentially affected by the remedial action.
Archaeological and Historic Preservation Act (16 U.S.C. § 469–469c-1)[b]					
Within area where action may cause irreparable harm, loss, or destruction of significant artifacts	Construction on previously undisturbed land would require an archaeological survey of the area. Data recovery and preservation would be required if significant archaeological or historical data were found on-site. The responsible official or Secretary of the Interior is authorized to undertake data recovery and preservation.	Regulated alteration of terrain caused as a result of a federal construction project or federally licensed activity or program where action may cause irreparable harm, loss, or destruction of significant artifacts.	16 U.S.C. § 469–469c-1 40 C.F.R. § 6.301(c)	Not an ARAR	There are no known or suspected historical resources in sediment at IR Site 24.
Historic Sites, Buildings, and Antiquities Act of 1935 (16 U.S.C. §§ 461–467)[b]					
Historic sites	Avoid undesirable impacts on landmarks.	Areas designated as historic sites.	16 U.S.C. §§ 461–467 40 C.F.R. § 6.301(a)	Not an ARAR	There are no known or suspected historical resources in sediment at IR Site 24.

Table A3-1 (continued)

Location	Requirement	Prerequisite	Citation[a]	ARAR Determination	Comments
Archaeological Resources Protection Act of 1979, as Amended (16 U.S.C. § 470aa–470mm)[b]					
Archaeological resources on federal land	Prohibits unauthorized excavation, removal, damage, alteration, or defacement of archaeological resources located on public lands unless such action is conducted pursuant to a permit.	Archaeological resources on federal land.	Pub. L. No. 96-95 16 U.S.C. § 470aa–470mm	Not an ARAR	There are no known or suspected archaeological resources at IR Site 24.
Exec. Order No. 11990, Protection of Wetlands[b]					
Wetland	Avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands and avoid support of new construction in wetlands if practicable alternatives exist.	Wetland meeting definition of Section 7.	40 C.F.R. § 6.302(a) and 40 C.F.R. pt. 6, app. A, § 6(a)(1), (3), and (5) (at the end of § 6.1007)	Not an ARAR	There is no proposed action that could affect a wetland.
Exec. Order No. 11988, Floodplain Management[b]					
Within floodplain	Evaluate potential effects of actions in a floodplain to avoid, to the extent possible, adverse effects associated with direct and indirect development of a floodplain.	Action that will occur in a floodplain (i.e., lowlands) and relatively flat areas adjoining inland and coastal waters and other flood-prone areas.	40 C.F.R. § 6.302(b) and 40 C.F.R. pt. 6, app. A, § 6(a)(1), (3), and (5) (at the end of § 6.1007)	Not an ARAR	IR Site 24 is not within a floodplain.
Clean Water Act of 1977, as Amended, Section 404 (33 U.S.C. § 1344)[b]					
Wetland	Action to prohibit discharge of dredged or fill material into wetland without permit.	Wetland as defined by Exec. Order No. 11990 Section 7.	33 U.S.C. § 1344	Not an ARAR	There is no proposed discharge to a wetland.

Table A3-1 (continued)

Location	Requirement	Prerequisite	Citation[a]	ARAR Determinati on	Comments
Resource Conservation and Recovery Act (42 U.S.C. §§ 6901–6991[i])[b]					
Within 100-year floodplain	Facility must be designed, constructed, operated, and maintained to avoid washout.	RCRA hazardous waste; treatment, storage, or disposal of hazardous waste.	Cal. Code Regs. tit. 22, § 66264.18(b)	Not an ARAR	IR Site 24 is not within a floodplain.
Wild and Scenic Rivers Act (16 U.S.C. §§ 1271–1287)[b]					
Within area affecting national wild, scenic, or recreational river	Avoid taking or assisting in action that will have direct adverse effect on scenic river.	Activities that affect or may affect any of the rivers specified in 16 U.S.C. §1276(a).	16 U.S.C. §§ 1271–1287	Not an ARAR	IR Site 24 remedial action could not potentially affect a wild and scenic river.
Fish and Wildlife Coordination Act (16 U.S.C. §§ 661–666c)[b]					
Area affecting stream or other water body	Action taken should protect fish or wildlife.	Diversion, channeling, or other activity that modifies a stream or other water body and affects fish or wildlife.	16 U.S.C. § 662	Applicable	Substantive provisions are potentially applicable for the dredging and filling alternatives that modify a water body and potentially affect fish or wildlife. The remedial action would be designed to prevent loss of or damage to fish and wildlife. See Section A3.2.3 for more information.

Table A3-1 (continued)

Location	Requirement	Prerequisite	Citation[a]	ARAR Determination	Comments
Rivers and Harbors Act of 1899 (33 U.S.C. §§ 401–413)					
Navigable waters	Permits required for structures or work in or affecting navigable waters.	Activities affecting navigable waters.	33 U.S.C. § 403 33 C.F.R. § 322	Not an ARAR	Not an ARAR because the regulated activities are not proposed for this remedial action. See further dredging and fill requirements identified as potential ARARs in Section A4 and Table A4-1.
Endangered Species Act of 1973 (16 U.S.C. §§ 1531–1543)[b]					
Habitat upon which endangered species or threatened species depend	Federal agencies may not jeopardize the continued existence of any listed species or cause the destruction or adverse modification of critical habitat. The Endangered Species Committee may grant an exemption for agency action if reasonable mitigation and enhancement measures such as propagation, transplantation, and habitat acquisition and improvement are implemented.	Determination of effect upon endangered or threatened species or its habitat. Critical habitat upon which endangered species or threatened species depend.	16 U.S.C. § 1536(a), (h)(1)(B)	Applicable	The California least tern, a state and federal listed endangered species, may use IR Site 24 as a forage area.

Table A3-1 (continued)

Location	Requirement	Prerequisite	Citation[a]	ARAR Determination	Comments
Marine Mammal Protection Act (16 U.S.C. §§ 1361–1421h)[b]					
Marine mammal area	Protects any marine mammal in the U.S. except as provided by international treaties from unregulated "take."	Presence of marine mammals.	16 U.S.C. § 1372 (a)(2)	Applicable	Because marine mammals are known to be present near IR Site 24, substantive provisions are potentially applicable if the selected response action could constitute a take of a marine mammal.
Magnuson-Stevens Fishery Conservation and Management Act of 1976, as Amended (16 U.S.C. §§ 1801–1882)[b]					
Fishery under management	Provides for conservation and management of specified fisheries within specified fishery conservation zones.	Presence of managed fisheries.	16 U.S.C. §§ 1801–1882	Not an ARAR	IR Site 24 is not within a specified fishery conservation zone, and there are no managed fisheries at the site.
Migratory Bird Treaty Act of 1972 (16 U.S.C. §§ 703–712)[b]					
Migratory bird area	Protects almost all species of migrating birds in the U.S. from unregulated "take," which can include poisoning at hazardous waste sites.	Presence of migratory birds.	16 U.S.C. § 703	Relevant and appropriate	Because migratory birds are known to be present near IR Site 24, substantive provisions are potentially relevant and appropriate.
National Wildlife Refuge System Administration Act of 1996 (16 U.S.C. § 668dd–668ee)[b]					
Wildlife refuge	No person shall take any animal or plant on any national wildlife refuge, except as authorized under 50 C.F.R. § 27.51. The disposing or dumping of wastes is prohibited.	Area designated as part of National Wildlife Refuge System.	16 U.S.C § 668dd–668ee Substantive provisions of 50 C.F.R. § 27.11–27.97	Not an ARAR	No wildlife refuge has been identified at IR Site 24.

Table A3-1 (continued)

Location	Requirement	Prerequisite	Citation[a]	ARAR Determination	Comments
Wilderness Act (16 U.S.C. §§ 1131–1136)[b]					
Wilderness area	Area must be administered in such a manner as will leave it unimpaired as wilderness and preserve its wilderness character.	Federally owned area designated as wilderness area.	16 U.S.C. §§ 1131–1136 50 C.F.R. § 35.1–35.14	Not an ARAR	No wilderness area identified at IR Site 24.
Resource Conservation and Recovery Act (42 U.S.C. §§ 6901–6991[i])[b]					
Within 61 meters (200 feet) of a fault displaced in Holocene time	New treatment, storage, or disposal of hazardous waste prohibited.	RCRA hazardous waste; treatment, storage, or disposal of hazardous waste.	Cal. Code Regs. tit. 22, § 66264.18(a)	Not an ARAR	No Holocene faults identified within 200 feet of IR Site 24.
Coastal Zone Management Act (16 U.S.C. §§ 1451–1464)[b]					
Within coastal zone	Conduct activities in a manner consistent with approved state management programs.	Activities affecting the coastal zone including lands thereunder and adjacent shore land.	16 U.S.C. § 1456(c) 15 C.F.R. pt. 930	Relevant and appropriate	Substantive provisions are potentially relevant and appropriate because IR Site 24 is considered to be within the coastal zone. See state coastal zone ARARs in Table A3-2.

Notes:

[a] only the substantive provisions of the requirements cited in this table are potential ARARs

[b] statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered potential ARARs

Table A3-1 (continued)

Acronyms/Abbreviations:
- app. – appendix
- ARAR – applicable or relevant and appropriate requirement
- Cal. Code Regs. – *California Code of Regulations*
- C.F.R. – *Code of Federal Regulations*
- DON – Department of the Navy
- Exec. Order No. – Executive Order Number
- IR – Installation Restoration (Program)
- pt. – part
- Pub. L. No. – Public Law Number
- RCRA – Resource Conservation and Recovery Act
- § – section
- tit. – title
- U.S.C. – *United States Code*
- USS – United States Ship

Table A3-2
Potential State Location-Specific ARARs

Location	Requirement	Prerequisite	Citation[a]	ARAR Determination	Comments
California Endangered Species Act (Cal. Fish & Game Code, ch. 1.5, §§ 2050–2116)[b]					
Endangered species habitat	No person shall import, export, take, possess, or sell any endangered or threatened species or part or product thereof.	Threatened or endangered species determination on or before January 1, 1985, or a candidate species with proper notification.	Cal. Fish & Game Code § 2080	Not ARAR	Not more stringent than federal requirements. See Table A3-1.
California Coastal Act of 1976[b]					
Coast	Regulates activities associated with development to control direct significant impacts on coastal waters and to protect state and national interests in California coastal resources.	Any activity that could impact coastal waters and resources.	Cal. Pub. Res. Code §§ 30000–30900; Cal. Code Regs. tit. 14, §§ 13001–13666.4	Not an ARAR	The San Francisco Bay, under the jurisdiction of the San Francisco Bay Plan, is exempt.
McAteer-Petris Act (Cal. Gov't. Code §§ 66600–66661)[a]					
Within the San Francisco Bay coastal zone	Reduce fill and disposal of dredged material in San Francisco Bay, maintain marshes and mudflats to the fullest extent possible to conserve wildlife, abate pollution, and protect the beneficial uses of the bay.	Activities affecting San Francisco Bay and 100 feet of the shoreline.	San Francisco Bay Plan at Cal. Code Regs. tit. 14, §§ 10110–11990	Relevant and appropriate	The remedial action at IR Site 24 is within the jurisdiction of the San Francisco Bay Plan.

Notes:
[a] only the substantive provisions of the requirements cited in this table are potential ARARs
[b] statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the entire statutes or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered potential ARARs

Table A3-2 (continued)

Acronyms/Abbreviations:
ARAR – applicable or relevant and appropriate requirement
Cal. Code Regs. – *California Code of Regulations*
Cal. Fish & Game Code – *California Fish and Game Code*
Cal. Gov't Code – *California Government Code*
Cal. Pub. Res. Code – *California Public Resources Code*
ch. – chapter
DON – Department of the Navy
IR – Installation Restoration (Program)
§ – section
tit. – title

Table A4-1
Potential Federal Action-Specific ARARs

1 – no action; 2 – ICs; 3 – MNR with ICs; 4 – thin-layer capping with ICs; 5 – sediment removal/dredging							
				ARAR Determination			
Action	**Requirement**	**Prerequisite**	**Citation**	**A**	**RA**	**TBC**	**Comments**
Resource Conservation and Recovery Act (42 U.S.C. §§ 6901–6991[i])*							
On-site waste generation	Person who generates waste shall determine if that waste is a hazardous waste.	Generator of waste.	Cal. Code Regs. tit. 22, § 66262.10(a), 66262.11	3, 4, 5			Potentially applicable for any operation where hazardous waste is generated. There is a potential for sediments from Seaplane Lagoon to be classified as RCRA hazardous waste. The determination of whether sediments are hazardous will be made after they are dewatered.
	Requirements for analyzing waste for determining whether waste is hazardous.	Generator of waste.	Cal. Code Regs. tit. 22, § 66264.13 (a) and (b)	3, 4, 5			The determination of whether sediments constitute hazardous waste will be made after they are dewatered. It is not anticipated that the sediments will be characterized as hazardous waste.
Hazardous waste accumulation	On-site hazardous waste accumulation is allowed for up to 90 days as long as the waste is stored in containers in accordance with § 66262.171–178 or in tanks, on drip pads, inside buildings, is labeled and dated, etc.	Accumulate hazardous waste.	Cal. Code Regs. tit. 22, § 66262.34	3, 4, 5			Potentially applicable for any operation where hazardous waste is generated and transported in containers. Not an ARAR for staging piles.

Table A4-1 (continued)

1 – no action; 2 – ICs; 3 – MNR with ICs; 4 – thin-layer capping with ICs; 5 – sediment removal/dredging							
				ARAR Determination			
Action	**Requirement**	**Prerequisite**	**Citation**	**A**	**RA**	**TBC**	**Comments**
Storage in containers	Containers of RCRA hazardous waste must be: • maintained in good condition, • compatible with hazardous waste to be stored, and • closed during storage except to add or remove waste.	Storage of RCRA hazardous waste not meeting small-quantity generator criteria before treatment, disposal, or storage elsewhere, in a container.	Cal. Code Regs. tit. 22, § 66264.171, 66264.172, and 66264.173	3, 4, 5			Potentially applicable for any operation where hazardous waste is generated and transported in containers. Not an ARAR for staging piles.
	Inspect container storage areas weekly for deterioration.		Cal. Code Regs. tit. 22, § 66264.174	3, 4, 5			Potentially applicable for any operation where hazardous waste is generated and transported in containers. Not an ARAR for staging piles.
	Place containers on a sloped, crack-free base, and protect from contact with accumulated liquid. Provide containment system with a capacity of 10 percent of the volume of containers of free liquids. Remove spilled or leaked waste in a timely manner to prevent overflow of the containment system.	Storage in a container of RCRA hazardous waste not meeting small-quantity generator criteria before treatment, disposal, or storage elsewhere.	Cal. Code Regs. tit. 22, § 66264.175(a) and (b)	3, 4, 5			Potentially applicable for any operation where hazardous waste is generated and transported in containers. Not an ARAR for staging piles.
	Keep containers of ignitable or reactive waste at least 50 feet from the facility property line.		Cal. Code Regs. tit. 22, § 66264.176				Not an ARAR. No ignitable or reactive waste expected at IR Site 24.

Table A4-1 (continued)

1 – no action; 2 – ICs; 3 – MNR with ICs; 4 – thin-layer capping with ICs; 5 – sediment removal/dredging							
				ARAR Determination			
Action	**Requirement**	**Prerequisite**	**Citation**	**A**	**RA**	**TBC**	**Comments**
Storage in containers (continued)	Keep incompatible materials separate. Separate incompatible materials stored near each other by a dike or other barrier.		Cal. Code Regs. tit. 22, § 66264.177	3, 4, 5			Potentially applicable for any operation where hazardous waste is generated and transported in containers. Not an ARAR for staging piles.
	At closure, remove all hazardous waste and residues from the containment system, and decontaminate or remove all containers and liners.		Cal. Code Regs. tit. 22, § 66264.178	3, 4, 5			Potentially applicable for any operation where hazardous waste is generated and transported in containers. Not an ARAR for staging piles.
Waste storage	Alternative requirements that are protective of human health or the environment may replace design, operating, or closure standards for temporary tanks and container storage areas.	RCRA hazardous waste, noncontainerized accumulation of solid, nonflammable hazardous waste that is used for treatment or storage.	Cal. Code Regs. tit. 22, § 66264.553 (b), (d), (e), and (f)	3, 4, 5			Substantive requirements are potentially applicable if waste is stored on-site in containers. Not an ARAR for staging piles.
	Allows generators to accumulate solid remediation waste in a U.S. EPA-designated pile for storage only, up to 2 years, during remedial operations without triggering LDRs.	Hazardous remediation waste temporarily stored in piles.	40 C.F.R. § 264.554(d)(1) (i–ii) and (d)(2), (e), (f), (h), (i), (j), and (k)	5			Substantive provisions are potentially applicable for dredged sediment storage. May be relevant and appropriate if dredged sediment is not hazardous but is similar to hazardous waste.

Table A4-1 (continued)

1 – no action; 2 – ICs; 3 – MNR with ICs; 4 – thin-layer capping with ICs; 5 – sediment removal/dredging					
Action	**Requirement**	**Prerequisite**	**Citation**	**ARAR Determination**	**Comments**
Waste storage (continued)	Minimize the need for further maintenance controls and minimize or eliminate, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated rainfall or runoff, or waste decomposition products to groundwater or surface water or to the atmosphere.	Staging pile closure	Cal. Code Regs. tit. 22, § 66264.111	5	Substantive provisions are potentially applicable for dredged sediment storage in staging piles. May be relevant and appropriate if dredged sediment is not hazardous but is similar to hazardous waste.
	Remove or decontaminate all waste residues, contaminated containment system components (liners, etc.), contaminated subsoils, and structures and equipment contaminated with waste and leachate, and manage them as hazardous waste.	Staging pile closure	Cal. Code Regs. tit. 22, § 66264.258(a)	5	Substantive provisions are potentially applicable for dredged sediment storage in staging piles. May be relevant and appropriate if dredged sediment is not hazardous but is similar to hazardous waste.

Table A4-1 (continued)

1 – no action; 2 – ICs; 3 – MNR with ICs; 4 – thin-layer capping with ICs; 5 – sediment removal/dredging							
				ARAR Determination			
Action	**Requirement**	**Prerequisite**	**Citation**	**A**	**RA**	**TBC**	**Comments**
Clean Water Act, as Amended (33 U.S.C. ch. 26, §§ 1251–1387)*							
Land disturbance	Stormwater plan and best management practice requirements.	Construction projects that disturb an acre or more of soil.	40 C.F.R. § 122.44(k)(2) and (4)				Not an ARAR. Less than an acre of soil is expected to be disturbed for this remedial action.
Discharge of dredged material	Guidelines for specification of disposal sites for dredged material. The discharge must represent the least damaging, practicable alternative. The discharge of dredged material must not result in significant degradation of the aquatic ecosystem. All practicable means must be utilized to minimize adverse environmental impacts.	Discharge of dredged or fill material to waters of the United States.	40 C.F.R. § 230.10(a), (c), and (d)	4, 5			Substantive provisions are potentially applicable for placing cap and backfilling after dredging. Not an ARAR during dredging since no dredging discharge is proposed.
	Factual determinations.	Discharge of dredged or fill material to waters of the United States.	40 C.F.R. § 230.11	4, 5			Substantive provisions are potentially applicable for placing cap and backfilling after dredging. Not an ARAR during dredging since no dredging discharge is proposed.
	Potential impacts on physical and chemical characteristics of the aquatic ecosystem that should be considered for factual determinations and when determining whether the discharge is allowed.	Discharge of dredged or fill material to waters of the United States.	40 C.F.R. § 230.20–230.25	4, 5			Substantive provisions are potentially applicable for placing cap and backfilling after dredging. Not an ARAR during dredging since no dredging discharge is proposed.

Table A4-1 (continued)

1 – no action; 2 – ICs; 3 – MNR with ICs; 4 – thin-layer capping with ICs; 5 – sediment removal/dredging							
				ARAR Determination			
Action	**Requirement**	**Prerequisite**	**Citation**	**A**	**RA**	**TBC**	**Comments**
Discharge of dredged material (continued)	Potential impacts on biological characteristics of the aquatic ecosystem should be considered for factual determinations and when determining whether the discharge is allowed.		40 C.F.R. § 230.31 and 230.32	4, 5			Substantive provisions are potentially applicable for placing cap and backfilling after dredging. Not an ARAR during dredging since no dredging discharge is proposed.
	Potential effects on human use characteristics should be considered for factual determinations and when determining whether the discharge is allowed.		40 C.F.R. § 230.53	4, 5			Substantive provisions are potentially applicable for placing cap and backfilling after dredging. Not an ARAR during dredging since no dredging discharge is proposed.
	General policies for evaluating permit applications		33 C.F.R. § 320.4	4, 5			Substantive provisions are potentially applicable for placing cap and backfilling after dredging. Not an ARAR during dredging since no dredging discharge is proposed.

Note:

* statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the statutes or policies in their entirety as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only pertinent substantive requirements of the specific citations are considered potential ARARs

Acronyms/Abbreviations:

A – applicable
ARAR – applicable or relevant and appropriate requirement
Cal. Code Regs. – *California Code of Regulations*
C.F.R. – *Code of Federal Regulations*
ch. – chapter
DON – Department of the Navy
IC – institutional control
IR – Installation Restoration (Program)
LDR – land disposal restriction
MNR – monitored natural recovery
RA – relevant and appropriate
RCRA – Resource Conservation and Recovery Act
§ – section
TBC – to be considered
tit. – title
U.S.C. – United States Code
U.S. EPA – United States Environmental Protection Agency

Table A4-2
Potential State Action-Specific ARARs

1 – no action; 2 – ICs; 3 – MNR with ICs; 4 – thin-layer capping with ICs; 5 – sediment removal/dredging

Action	Requirement	Prerequisite	Citation	ARAR Determination A	ARAR Determination RA	ARAR Determination TBC	Comments
California Environmental Protection Agency Department of Toxic Substances Control*							
Land-use covenants	A land-use covenant imposing appropriate limitations on land use shall be executed and recorded when Facility closure, corrective action, remedial or removal action, or other response actions are undertaken and hazardous materials, hazardous wastes or constituents, or hazardous substances will remain at the property at levels that are not suitable for unrestricted use of the land.	Property transfer by federal government to nonfederal entity.	Cal. Code Regs. tit. 22, § 67391.1		2, 3, 4		Cal. Code Regs. tit. 22, § 67391.1 provides for a land-use covenant to be executed and recorded when remedial actions are taken and hazardous substances will remain at the property at concentrations that are unsuitable for unrestricted use of the land. The substantive provisions of this regulation have been determined to be relevant and appropriate state ARARs by the DON. See Section A4.2 for DTSC and U.S. EPA positions.
California Civil Code*							
Land-use controls	Provides conditions under which land-use restrictions will apply to successive owners of land.	Transfer property from the DON to a nonfederal agency.	Cal. Civ. Code § 1471		2, 3, 4		Substantive provisions are potentially relevant and appropriate because the DON is transferring property to a nonfederal agency. Generally, Cal. Civ. Code § 1471 allows an owner of land to make a covenant to restrict the use of land for the benefit of a covenantee. The covenant runs with the land to bind successive owners, and the restrictions must be reasonably necessary to protect present or future human health or safety or the environment as a result of the presence on the land of hazardous materials, as defined in Cal. Health & Safety Code § 25260. Substantive

Table A4-2 (continued)

1 – no action; 2 – ICs; 3 – MNR with ICs; 4 – thin-layer capping with ICs; 5 – sediment removal/dredging							
				ARAR Determination			
Action	**Requirement**	**Prerequisite**	**Citation**	**A**	**RA**	**TBC**	**Comments**
Land-use controls (continued)							provisions are the following general narrative standard: "to do or refrain from doing some act on his or her own land . . . where (c) Each such act relates to the use of land and each such act is reasonably necessary to protect present or future human health or safety or the environment as a result of the presence of hazardous materials, as defined in Section 25260 of the California Health and Safety Code." This narrative standard would be implemented through incorporation of restrictive covenants in the deed and Environmental Restriction and Covenant Agreement at the time of transfer. See Section A4.2 for DTSC and U.S. EPA positions.
California Health and Safety Code*							
Land-Use controls	Allows DTSC to enter into an agreement with the owner of a hazardous waste facility to restrict present and future land uses.	Transfer property from the DON to a nonfederal agency.	Cal. Health & Safety Code § 25202.5		2, 3, 4		Substantive provisions are potentially relevant and appropriate because the DON is transferring property to a nonfederal agency. The substantive provisions of Cal. Health & Safety Code § 25202.5 are the general narrative standards to restrict "present and future uses of all or part of the land on which the…facility…is located…." See Section A4.2 for DTSC and U.S. EPA positions.

Table A4-2 (continued)

1 – no action; 2 – ICs; 3 – MNR with ICs; 4 – thin-layer capping with ICs; 5 – sediment removal/dredging							
				ARAR Determination			
Action	Requirement	Prerequisite	Citation	A	RA	TBC	Comments
Land-use controls (continued)	Prohibits certain uses of land containing hazardous waste without a specific variance.	Transfer of hazardous waste property from the DON to a nonfederal agency.	Cal. Health & Safety Code § 25232(b)(1)(A) –(E)		2, 3, 4		Substantive provisions are potentially relevant and appropriate because the DON is transferring property to a nonfederal agency. Land-use restrictions will be used to prohibit the following activities at IR Site 24: residential use of the sites, construction of hospitals for humans, schools for persons under 21 years of age, day care centers for children, or any permanently occupied human habitation on the sites. See Section A4.2 for the DTSC and U.S. EPA positions.
	Provides a streamlined process to be used to enter into an agreement to restrict specific use of property in order to implement the substantive use restrictions of Cal. Health & Safety Code § 25232(b)(1)(A)–(E).	Transfer property from the DON to a nonfederal agency.	Cal. Health & Safety Code §§ 25222.1 and 25355.5(a)(1)(C)		2, 3, 4		Generally, Cal. Health & Safety Code §§ 25222.1 and 25355.5(a)(1)(C) provide the authority for the DTSC to enter into voluntary agreements with land owners to restrict the use of property. The agreements run with the land restricting present and future uses of the land. The substantive requirements of the following Cal. Health & Safety Code § 25222.1 provisions are "relevant and appropriate": (1) the general narrative standard: "restricting specified uses of the property…" and (2) "…the agreement is irrevocable, and shall be recorded by the owner, …as a hazardous waste easement, covenant,

Table A4-2 (continued)

1 – no action; 2 – ICs; 3 – MNR with ICs; 4 – thin-layer capping with ICs; 5 – sediment removal/dredging							
				ARAR Determination			
Action	**Requirement**	**Prerequisite**	**Citation**	**A**	**RA**	**TBC**	**Comments**
Land-use controls (continued)							restriction or servitude, or any combination thereof, as appropriate, upon the present and future uses of the land." The substantive requirements of the following Cal. Health & Safety Code § 25355.5(a)(1)(C) provisions are relevant and appropriate: "...execution and recording of a written instrument that imposes an easement, covenant, restriction, or servitude, or combination thereof, as appropriate, upon the present and future uses of the land." See Section A4.2 for the DTSC and U.S. EPA positions.
	Provides processes and criteria for obtaining written variances from a land-use restriction and for removal of the land-use restrictions.	Transfer property from the DON to a nonfederal agency.	Cal. Health & Safety Code §§ 25233(c) and 25234		2, 3, 4		Substantive provisions are potentially relevant and appropriate for ICs because the DON is transferring property to a nonfederal agency. Cal. Health & Safety Code § 25233(c) sets forth relevant and appropriate substantive criteria for granting variances based upon specified environmental and health criteria. Cal. Health & Safety Code § 25234 sets forth the following relevant and appropriate substantive criteria for the removal of a land-use restriction on the grounds that "...the waste no longer creates a significant existing or potential hazard to present or future public health or safety." See Section A4.2 for DTSC and U.S. EPA positions.

Table A4-2 (continued)

Note:

* statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the DON accepts the statutes or policies in their entirety as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only pertinent substantive requirements of the specific citations are considered potential ARARs

Acronyms/Abbreviations:

A – applicable
ARAR – applicable or relevant and appropriate requirement
Cal. Civ. Code – *California Civil Code*
Cal. Code Regs. – *California Code of Regulations*
Cal. Health & Safety Code – *California Health and Safety Code*
DON – Department of the Navy
DTSC – (California Environmental Protection Agency) Department of Toxic Substances Control
IC – institutional control
IR – Installation Restoration (Program)
RA – relevant and appropriate
§ – section
TBC – to be considered
tit. – title
U.S. EPA – United States Environmental Protection Agency

ATTACHMENT A1

LETTER OF NOVEMBER 13, 1996, FROM DTSC TO NAVY

NAS ALAMEDA
SSIC No. 5090.3

Cal/EPA

Department of Toxic Substances Control

700 Heinz Avenue
Suite 200
Berkeley, CA
94710-2737

Pete Wilson
Governor

James M. Strock
Secretary for Environmental Protection

November 13, 1996

Commander
Engineering Field Activity, West
Naval Facilities Engineering Command
Attn: Camille Garibaldi
900 Commodore Drive
San Bruno, California 94066-2402

Dear Ms. Garibaldi:

APPLICABLE RELEVANT AND APPROPRIATE REQUIREMENTS FOR THE NAVAL AIR STATION, ALAMEDA

The California Department of Toxic Substances Control (DTSC), is in receipt of the Navy's September 12, 1996 letter requesting Applicable or Relevant and Appropriate Requirements (ARARs) from the State of California for the Remedial Investigation and Feasibility Study of the Naval Air Station, Alameda. Enclosed in this document are State laws and regulations that California State Agencies believe may apply to the environmental remediation of Naval Air Station (NAS) Alameda.

As lead regulatory agency and a partner with the Navy and the United States Environmental Protection Agency (EPA) in conducting the remediation of NAS Alameda, we propose that a workshop be scheduled with all responsible State and Federal agencies to establish the ARARs for the NAS Alameda remediation. We also encourage the participation of the Restoration Advisory Board in the workshop. The invitation to participate in the workshop shall include a new solicitation for ARARs from the invited agencies.

We hope you are in agreement with us on this proposal. We anticipate the process to establish ARARs to be a consensual process based on our mutual goals and our partnership as lead agencies responsible for the protection of human health and the environment at NAS Alameda.

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NOV 20 1996

Ms. Camille Garibaldi
November 13, 1996
Page Two

If you wish to discuss this letter, the enclosures, or the proposal, please call me at (510) 540-3809.

Sincerely,

Thomas P. Lanphar
Project Manager
Base Closure Branch

Enclosures

cc's: Ms. Gina Kathuria
Regional Water Quality Control Board
2101 Webster Street, Suite 500
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Base Environmental Coordinator
Alameda Naval Air Station
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San Bruno, California 94066-2402

Ms. Ardella Dailey
Community Co-Chair
Restoration Advisory Board
2200 Central Avenue
Alameda, California 94501

California Laws, Regulations and Policies
for Potential Application at the
Naval Air Station, Alameda
November 12, 1996

I. Generation, Storage and Treatment of Hazardous Waste

A. California Code of Regulations (CCR), Title 22, Chapter 11, Identification and listing of hazardous wastes. Chapter identifies those waste that are subject to regulations hazardous waste and are subject to the notification requirements of Health and Safety Code section 25153.6.

1. Article 1: General; purpose and scope, definition of waste and hazardous waste, exclusions, requirements for recyclable materials and contaminated containers. (66261.1 - 66261.7)

2. Article 2: Criteria for identifying Characteristics of Hazardous Waste. (66261.10)

3. Article 3: Characteristics of Hazardous Waste. (66261.20 - 66261.35)

4. Article 4: List RCRA Hazardous Waste. (66261.30 - 66261.35)

5. Article 5: Categories of Hazardous Waste. (66261.100 - 66261.126)

B. CCR, Title 22, Chapter 12, Standards Applicable to generator of hazardous waste

1. Article 1: Applicability. A generator of a waste must determine if waste is hazardous, and if so obtain an identification number. (66262.10 - 66262.12)

2. Article 2: A generator who transports, or offers for transportation, hazardous waste for off-site transfer, treatment, storage or disposal shall prepare a Manifest. (66262.20 - 66262.23)

3. Article 3: Pre-transport Requirements include packaging, labeling, marking, and placarding. Article also identifies maximum accumulation time for hazardous waste prior to transport to permitted hazardous waste facility.

4. Article 4: Record keeping and Reporting. Establishes requirements for the generator to keep records of manifests and other hazardous waste generation activities.

5. Article 5: Export of Hazardous Waste. This article establishes requirements applicable to exports of hazardous waste to a foreign country from the State. Except to the extent 40 CFR section 262.58 provides otherwise, a primary exporter of hazardous waste shall comply with the requirements of this article.

C. CCR, Title 22, Chapter 14, Standards for Owners and operators of hazardous wastes transfer, treatment, storage and disposal facilities.

1. Article 2: Requirements apply to the owners and operators of hazardous waste facilities. These requirements are for inspection, Personal Training, General Requirements, Location Standards, Construction Quality Assurance Program, Seismic and precipitation design standards. (66264.13 - 66264.25)

2. Article 3: Preparedness and prevention apply to of hazardous waste facility. These are related to design and operation, required equipment, testing and maintenance of equipment, access to communication or alarm system, required aisle space and informing the local authorities. 66264.30 - 66264.37

3. Article 4: Contingency and emergency procedures apply to the owners and operators of hazardous waste facilities. The owners and operators shall have contingency plan for the facility. 66264.52 - 66264.56

4. Article 5: Manifest System, Recordkeeping, and Reporting. The regulations in this article apply to owners and operators of both on-site and off-site facilities. 66264.71 - 66264.77

5. Article 6: Water Quality Monitoring and Response Programs for Permitted Facilities.

6. Article 7: Closure and Post-Closure. Requirements apply to the owners and operators of hazardous waste management facilities. 66264.111 through 66264.120

7. Article 9: Use and management of containers.

8. Article 10: Requirements that apply to the owners and operators of facilities that use Tank Systems[66264.190 - 66264.199]

9. Article 11: Regulations in this article apply to owners and operators of facilities that use surface impoundment to treat, store or dispose of hazardous waste. 66264.221 through 66264.231

10. Article 12: Regulations in this article apply to owners and operators of facilities that store or treat hazardous waste in piles unless exempt. 66264.251 through 66264.259.

11. Article 13: Land Treatment. Applies to treatment or disposal of hazardous waste in land treatment units. Requires demonstration of treatment of waste prior to application. 66264.270 - 66264.283

12. Article 14: This article applies to disposal of hazardous waste in Landfills. 66264.300 - 66264.318

13. Article 15.5: The regulations in this article apply to the construction of Corrective Action Management Units for the management of remediation waste. The DTSC may designate one or more CAMUs. Placement of remediation waste does not constitute land disposal. Temporary units may also be designated for the storage or treatment of remediation waste. 66264.500 - 66264.553

14. Article 27: Regulations in this article apply to owners and operators of facilities that treat, store or dispose of RCRA hazardous waste by process vents associated with distillation, fraction, thin-film evaporation, solvent extraction, or air steam stripping. 66264.1030 through 1035

15. Article 28: Regulations in this article apply to owners and operators of facilities that treat, store or dispose of RCRA hazardous waste, unless exempt. 66264.1052 through 66264.1065

D. CCR, Title 22, Chapter 16, Recyclable Materials (Recyclable hazardous waste)

1. Article 1: Identifies recyclable hazardous waste types including: solvents, petroleum products, pickling liquor, unspent acids, unspent alkalis, unrinsed empty containers. 66266.1 - 66266.2

2. Article 2. This article applies to the generation,

transportation, and facility operation requirements. A generator of a recyclable hazardous material shall comply with all of the hazardous waste requirements except for the Extremely Hazardous Waste Disposal Permit requirements. 66266.3 - 66266.5

E. CCR, Title 22, Chapter 18, Land Disposal Restrictions

1. Article 1: Identifies hazardous waste that are restricted from land disposal. 66268.1 - 66268.9

2. Article 2: Contains schedule for land disposal prohibition and establishment of treatment standards. 66268.10 - 66268.29

3. Article 3: Contains prohibitions on Land Disposal. 66268.30 - 66268.38

4. Article 4: This article identifies treatment standards. 66268.40 - 66268.48

5. Article 5: Identifies prohibitions on storage of waste restricted from land disposal. 66268.50

6. Article 10: Identifies land disposal prohibitions of non-RCRA hazardous waste. 66268.100

7. Article 11: Contains treatment standards for non-RCRA waste categories. 66268.105 - 66268.114

II. Investigation and Remediation of Hazardous Substance Release Sites

A. California Health and Safety Code, Chapter 6.5. Hazardous Substance Account

1. Section 25187: Authorizes the Department to issue corrective action orders.

a. Remedial Action Order, Issued 1988 by the DTSC to the Naval Air Station, Alameda

B. California Health and Safety Code, Chapter 6.8. Hazardous Substance Account

1. Article 2: Definitions

a. 25319.5 "Preliminary Endangerment Assessment". Activity which is performed to determine whether current or past waste management practices have resulted in the release or threatened release of hazardous substances which pose a threat to public health or the environment. 8-3-89

b. 25323.1 "Removal Action Workplan" A workplan approved by the DTSC or RWQCB to carry out a removal action. Includes: detailed engineering plan, description of onsite contamination, goals, and alternatives removal options that were considered and rejected and the basis for that rejection.

2. Article 5, Section 25355: Authorizes the Department to take over remedial actions at a hazardous substance release site if the Responsible Parties are not in compliance.

3. Article 5, Section 25355.5(a)(1)(B): Identifies requirements

4. Article 5, Section 25356.1, Remedial Action Plans and Removal Action Workplans

   a. Section 25356.1(d): All RAPs must be based upon Section 25350, Subpart F of the NCP and upon factors identified in this subsection.

   b. Section 25356.1(e): Identifies community involvement requirements as they relate to a RAP.

   c. Section 25356.1(f): Authorizes the DTSC to issue the final RAP.

   d. Section 25356.1(h): Exemptions to the RAP requirements.

      (1) Section 25356.1(h)(1): Authorizes the DTSC to prepare a Removal Action Workplan if the estimated cost of the removal action is less than $1,000,000. Identifies community involvement requirements for a RAW.

      (2) Section 25356.1(h)(2): A RAP is not required if the site listed on the National Priority List by the EPA.

      (3) Section 25356.1(h)(3): Authorizes DTSC to waive the RAP requirements in subdivision (d) if certain conditions apply, including estimated costs for remedial action below $2,000,000.

5. Article 5, Section 25358.1: Rights of the DTSC to

take actions at known or suspected hazardous substance release sites.

a. Section 25358.1(b)(1): The DTSC may require any potentially responsible party to furnish information on materials generated, stored, treated or disposed of at a hazardous substance release site

b. Section 25358.1(b)(2) The DTSC may require any potentially responsible party to furnish information on the nature or extent of a release or a threatened release of a hazardous substance at a hazardous substance release site.

6. Article 5, Section 25358.3(a): Authorizes the DTSC to take action in situations posing an imminent and substantial endangerment.

7. Article 5, Section 25358.3(b),(c): Authorizes the DTSC to undertake investigations whenever there has been a release or threat of a release of hazardous substances to the environment.

8. Article 5, Section 25358.4: Requires that all analysis of material to determine if it is hazardous must be done by a state certified and accredited laboratory.

9. Article 5, Section 25358.7: Identifies the right of any interested party who may be affected by remedial actions at a site to become involved in the DTSC decision making process.

10. Article 5, Section 25358.9: Authorizes the DTSC, to the extent consistent with RCRA, to exclude any portion of a response action conducted entirely onsite from the hazardous waste facility permit requirements of Section 25201 if both the following apply:

    a. The removal or remedial action is carried out pursuant to a removal action workplan or a remedial action plan approved by the DTSC.

    b. The RAW or RAP complies with all substantive requirements.

11. Article 5, Section 25359: Authorizes the DTSC to access punitive damages on Responsible Parties who fail to comply with clean-up and remediation orders.

12. Article 5, Section 25359.5: Authorizes the DTSC to issue 'Fence and Post' Orders and establishes their requirements.

13. Article 5, Section 25359.7: Requires a property owner to inform buyers of unmitigated hazardous substance releases on that property.

14. Article 6, Section 25367: Establishes penalties for the making of false claims and misrepresentations related to the release of hazardous substances to the environment.

C. California Health and Safety Code, Chapter 6.6: Safe Drinking Water and Toxic enforcement Act of 1986 (Prop. 65).

1. Section 25249.5: Prohibits the release, to drinking water, of hazardous substances which cause cancer or which have reproductive toxicity.

D. Preliminary Endangerment Assessment Guidelines, January 1995

III. Protection of Air Quality

A. Bay Area Air Quality Management District(BAQMD), Regulation 8, Rule 40, "Aeration of Contaminated Soil and Removal of Underground Storage Tanks:

B. BAAQMD, Regulation 8, Rule 47 "Air Stripping and Soil Vapor Extraction Operations"

IV. Soil Storage

A. Assembly Bill 1060, Richter (Chapter 627, Statutes of 1995): allow generators to hold contaminated soil from site cleanup projects in waste pile for up to one year or 18 months for purposes of offsite transportation, subject to certain conditions.

V. Sediment and Wetland Remediation

A. Endangered and Rare Species Protection

1. California Endangered Species Act of 1973

a. Fish and Game Code Section 2050; 2065

2. Requirements for endangered or rare species: Fish and Game Code Section 1900 et seq.; 2050 et seq. to 2068; 2070; 2080; 2090 et seq. to 2096;

3. Federal Endangered Species Act of 1973

B. Protection of fish and wildlife resources and their habitats

1. Designation of the Department of Fish and Game as trustee for State fish and wildlife resources: fish and Game Code Section 711.7;

2. Possession permit for scientific purposes, etc.: Fish and Game code Section 1002

3. Requirements for releasing substances deleterious to fish and wildlife: fish and Game Code Section 5650 (a)(b),(f): 5651; and 12016;

4. Illegal take of birds and mammals: Fish and Game Code Section 3003;

5. Relevant policies for the general protection and conservation of fish and wildlife resources: fish and Game Code Section 1600; 1700; 1750; 1801; and 2014; Water Code Section 1243

C. Federal Coastal Zone Management Act (16 USC 1456(c)(3)(A)): federal actions or federally funded or approved actions that affect the coastal zone must be consistent with the policies of the San Francisco Bay Conservation and Development Commission's federally approved coastal management program.

1. Elements of the BCDC's coastal management program:

a. McAteer-Petris Act

b. BCDC regulations

c. SF Bay Plan

d. SF Bay Area Seaport Plan: NAS Alameda designated as port priority

2. SFBCDC policies:

a. Fish and Wildlife: to the greatest extent feasible, remaining marshes and mudflats around the Bay, the remaining water volume and surface area of the Bay, and adequate freshwater inflow to the Bay should be maintained. Specific habitats that are needed to prevent the extinction of any species, or to maintain or increase any species that would provide substantial public benefits should be protected, whether in the

Bay or on the shoreline.

b. Water Quality: follow State Water Resources Control Board and the San Francisco Bay Regional Water Quality Control Board. Bay marshes, mudflats, and water surface area and volume should be maintained and, wherever possible, increased.

c. Marshes and Mudflats: Marshes and mudflats are integral part of the Bay tidal system and, therefore, should be protected in the same manner as open water area. Filling and diking should only be allowed for purposes providing substantial public benefits and only if there is no reasonable alternative.

d. Mitigation: Mitigation should consist of measures to compensate for the adverse impacts of Bay fill to the natural resources of the Bay, such as to water surface area, volume, or circulation, and to fish and wildlife habitat or marshes or mudflats. Mitigation is no a substitute for meeting the other requirements of the McAteer-Petris Act concerning fill.

VI. Protection and Remediation of Groundwater

A. CCR, Title 23, Division 3, Chapter 15

1. Governs the discharge of waste to land for treatment, storage, and disposal and establish siting, containment, monitoring, and closure requirements

B. State Water Resources Control Board Resolution Number 68-16 (Statement of Policy with Respect to Maintaining High Quality of Waters in California), October 28, 1968

1. Requires the continued maintenance of high quality waters of the state even where that quality is better than needed to protect beneficial uses, unless specific findings are made.

2. Chemical-specific and action-specific

3. Beneficial uses of groundwater must be defined for NAS Alameda

C. State Water Resources Control Board Resolution 88-63 (Adoption of Policy Entitled "Sources of Drinking

Water"), May 19, 1988

1. The Resolution states that, with few specific exceptions, all surface and groundwaters of the state are to be considered existing drinking water sources except where the TDS is greater than 3000 ppm, the well yield is less than 200 gpd from a single well, the water is a geothermal

D. State Water Resources Control Board Resolution 92-49 (As Amended on April 21, 1994), (Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code Section 13304), July 8, 1994

E. Water Quality Control Plan, San Francisco Bay Basin Region, December 1986; and September 29, 1992 Basin Plan Amendments

F. California Code of Regulations, Title 22, Chapter 15, Domestic Water Quality Criteria and Monitoring

1. Article 4: Primary Standard - Inorganic Chemicals. Identifies Maximum Contaminant Levels in drinking water supplies. 64431.0 - - 64437.0

2. Article 4.5: Primary Standard - Organic Chemicals. Identifies Maximum Contaminant Levels in drinking water supplies. 64444.0 - - 64445.2

G. Title 3, Food and Agriculture; Division 6, Pesticides and Pest Control Operations; Chapter 4, Environmental Protection; Subchapter 1, Groundwater; Article 1, Pesticide Contamination Prevention.

1. Lists of pesticides labeled for agricultural, outdoor institutional or outdoor industrial use that contain chemicals designated as having the potential to pollute groundwater.

State ARARs for Solid Waste Disposal Site Closure and Postclosure Maintenance

Source	Standard, Requirement, Criterion, or Limitation	ARAR Status	Description	Comment	Associated Site
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17766 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Emergency Response Plan (ERP): potential emergency conditions that may exceed the design of the site and could endanger the public health or environment must be anticipated. Response procedures for these conditions must be addressed in the RD/RA plans.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17767 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Security at Closed Sites: all points of access to the site must be restricted, except permitted entry points. All monitoring, control, and recovery systems shall be protected from unauthorized access.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17773 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Final Cover: the design and construction of the final cover must meet specific prescriptive standards of 23 CCR 2581(a). These include minimum thickness and quality of the construction material. If the prescriptive standard is not feasible then an engineered alternative that meets the performance goals (i.e. limiting infiltration, controlling gas emissions, compatibility with reuse) can be proposed.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17774 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Construction Quality Assurance (CQA): a CQA program must be designed and implemented. It must include specific parameters (and for some components specific testing methods) for each component of the final cover.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17776 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Final Grades: the final grades for the covered landfill must meet grading standards provided in 23 CCR 2581, they must be appropriate to control run-off and erosion.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17777 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Final Site Face: the design of the final site face must provide for the integrity of the final cover both under static and dynamic conditions	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17778 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Final Drainage: the design of the final cover must control runon and runoff produced by a 100 year 24 hour storm event and must be prepared according to CQA requirements.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17779 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Slope Protection and Erosion Control: the design and construction of the slopes must protect the integrity of the final cover and minimize soil erosion	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17781 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Leachate Control During Closure and Post Closure: leachate must be monitored, collected, treated, and discarded appropriately.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760. The state does not intend that subsurface leachate monitoring and collecting systems need to be added to existing landfills unless leachate production and/or accumulation is evident.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17783 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Gas Monitoring and Control During Closure and Post Closure: landfill gases must be collected and analyzed; the concentration of combustible gas at the landfill boundary must be 5% or less, trace gases must not be at levels that cause adverse health or environmental impacts.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17760.	For closing sites

State ARARs for Solid Waste Disposal Site Closure and Postclosure Maintenance

Source	Standard, Requirement, Criterion, or Limitation	ARAR Status	Description	Comment	Associated Site
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17788 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Post Closure Maintenance: the landfill must be maintained and monitored for no less than 30 years following closure.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17766.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43020	14 CCR 17796 Chapter 3, Article 7.8 Disposal Site Closure and Postclosure Maintenance	Applicable or Relevant and Appropriate	Post Closure Land Use: The Closure Design shall show one or more proposed uses of the closed site or show development that is compatible with open space. Changes in postclosure land use must be approved by the appropriate State agency prior to implementation.	Closure or Postclosure Maintenance Standard of Title 14, CCR, Chapter 3, Article 7.8. Scope and Applicability pursuant to 14 CCR 17766.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43509	14 CCR 18261.3 Chapter 5, Article 3.4 Closure and Postclosure Maintenance Plans	Relevant and Appropriate	Provides the content requirements for closure plans for solid waste disposal sites.	Applies to solid waste disposal sites that received waste after January 1, 1988. Relevant and appropriate for closing sites that did not receive waste after January 1, 1988.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43509	14 CCR 18265.3 Chapter 5, Article 3.4 Closure and Postclosure Maintenance Plans	Relevant and Appropriate	Provides the content requirements for postclosure maintenance plans for solid waste disposal sites.	Applies to solid waste disposal sites that received waste after January 1, 1988. Relevant and appropriate for closing sites that did not receive waste after January 1, 1988.	For closing sites
California Integrated Waste Management Act of 1989 PRC 40502 & 43509	14 CCR 18275 Chapter 5, Article 3.4 Postclosure Maintenance Plans	Relevant and Appropriate	Provides the content requirements to obtain certification that the solid waste disposal sites has closed pursuant to state standards.	Applies to solid waste disposal sites that received waste after January 1, 1988 Relevant and appropriate for closing sites that did not receive waste after January 1, 1988.	For closing sites

14 CCR - California Code of Regulations, Title 14 ARAR - applicable or relevant and appropriate requirement ROD - Record of Decision RD/RA - remedial design/remedial action

ATTACHMENT A2

LETTER OF NOVEMBER 8, 2007, FROM NAVY TO DTSC CONCERNING IDENTIFICATION OF STATE ARARs

DEPARTMENT OF THE NAVY
BASE REALIGNMENT AND CLOSURE
PROGRAM MANAGEMENT OFFICE WEST
1455 FRAZEE RD, SUITE 900
SAN DIEGO, CA 92108-4310

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CERTIFIED MAIL, RETURN RECEIPT REQUESTED

Ms. Dot Lofstrom
Project Manager
Northern California Operations
Department of Toxic Substances Control
8800 Cal Center Drive
Sacramento, CA 95826-3200

Dear Ms. Lofstrom:

Subj: IDENTIFICATION OF STATE "APPLICABLE" OR "RELEVANT AND APPROPRIATE" REQUIREMENTS (ARARS) FOR THE FEASIBILITY STUDY (FS) AT INSTALLATION RESTORATION (IR) SITE 24, PIER AREA, ALAMEDA POINT, ALAMEDA, CALIFORNIA

Pursuant to our previous discussion and paragraphs of the Federal Facility Agreement (FFA) [¶10.6, (a) and (b)] we are hereby requesting that the Department of Toxic Substances Control (DTSC) as the lead agency for the State of California, identify potential State chemical-specific, location-specific, and action-specific ARARs for IR Site 24. ARARs identified will be considered and evaluated in the FS for the site.

In our final RI Report for IR Site 24 of August 2007, we transmitted to you site characterization data for IR Site 24. The site characterization data should allow you to begin to identify, with some specificity, State chemical-, location-, and action-specific ARARs.

In addition, the Department of the Navy is requesting that the State of California identify any other criteria, advisories, guidance, and proposed standards that the State requests be considered (TBCs) for the above-identified IR Site, which has entered the FS phase.

As indicated in the Final RI Report, the FS for IR Site 24 will address metals and organic compounds in sediment that are the major risk drivers for the ecological risk. A list of tentative response action technologies is provided below to assist in identification of potential action-specific ARARs:

- Institutional Controls (ICs)
- Monitored Natural Recovery
- Thin Layer Cap
- Dredging

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Timely identification of potential State ARARs is required under Section 121(d) (2)(A) of CERCLA and under the National Contingency Plan (NCP), 40 CFR §§300.400(g) and 300.515(d) & (h).

Experience to date around the country has shown that a failure to identify ARARs with sufficient precision, early in the RI/FS process, can cause severe disruptions n timely implementation of remedial action. To ensure timely and complete ARARs identification for IR Site 24, please include the following information:

1. A specific citation to the statutory or regulatory provision(s) for the potential State ARARs and the date of enactment or promulgation.

2. A brief description of why the potential State ARARs is applicable or relevant and appropriate to the particular OU (or IR Site).

3. A brief description of how the potential State ARAR would apply to potential remedial action, including: specific numeric discharge, effluent, or emission limitations; substance/constituent action or cleanup levels; etc., if the State intends to take the position that the potential State ARAR includes such limitations, levels, etc.

4. If the State believes its proposed ARAR is more stringent than the corresponding Federal ARAR, please provide the rationale and technical justification for this position.

5. If the State determines that there is not enough information to fully respond to our request, please identify any additional information that would be required to support identification of State ARARs and their application.

Consistent with 40 CFR §300.515(h)(2), we are requesting that you send a response via first class mail addressed to me and postmarked within 30 calendar days of receipt of this request. Please direct any technical questions that you may have concerning this request to Ms. Mary Parker (619) 532-0945 and any legal questions to Mr. Rex Callaway, Associate Counsel (Environmental), NAVFC SW (619) 532-0988.

Sincerely,

THOMAS L. MACCHIARELLA
BRAC Environmental Coordinator
By direction of the Director

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Copy to:
Ms Anna-Marie Cook
U. S. Environmental Protection Agency
Region 9
75 Hawthorne Street
San Francisco, CA 94105-3901

Mr. John West
Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612

APPENDIX B

COST DEVELOPMENT SUMMARIES

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ACRONYMS/ABBREVIATIONS

AOEC	area of ecological concern
bcy	bank (in-place) cubic yard
BEI	Bechtel Environmental, Inc.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm	centimeters
COC	chemical of concern
FS	feasibility study
IC	institutional control
IR	Installation Restoration (Program)
MNR	monitored natural recovery
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
O&M	operation and maintenance
OSWER	Office of Solid Waste and Emergency Response
PCB	polychlorinated biphenyl
QA	quality assurance
QC	quality control
RACER	Remedial Action Cost Engineering and Requirements (System)
RAO	remedial action objective
RG	remediation goal
RI	remedial investigation
ROD	record of decision
U.S. EPA	United States Environmental Protection Agency

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Appendix B
COST DEVELOPMENT SUMMARIES

This appendix documents the development of order-of-magnitude cost estimates for Installation Restoration (IR) Program Site 24 remedial alternatives evaluated in this Feasibility Study (FS) Report. The no action alternative (Alternative 1) has no associated costs and is therefore not discussed in this appendix.

The cost estimates developed in this appendix are solely for comparing alternatives in this FS Report and should not be used for budgeting or planning purposes.

B1 METHODOLOGY

Cost estimates for this FS Report were prepared following United States Environmental Protection Agency (U.S. EPA) technical guidance (U.S. EPA 1987, 1988, 2000) and the National Oil and Hazardous Substances Contingency Plan (NCP). The Remedial Action Cost Engineering and Requirements (RACER) system was the primary source of cost data. Costs for site-specific or unique line items were based on vendor quotes. Microsoft Excel spreadsheets were used to tabulate costs on an annual basis and calculate present values in January 2007 dollars.

B1.1 Description of RACER

RACER cost models are based on generic engineering solutions for environmental projects, technologies, and processes. The engineering solutions were derived from historical project information, government laboratories, construction management agencies, vendors, contractors, and engineering analyses. The software used for estimating cost, RACER 2007, incorporates the most up-to-date engineering practices and procedures to accurately reflect current removal/remediation processes and pricing. When an estimate is developed using RACER, generic engineering solutions are customized by adding site-specific parameters to reflect project-specific conditions and requirements. The tailored plan is then translated into specific work items that are priced using the current cost data. RACER incorporates and summarizes cost by the code of accounts that was developed by the interagency Cost Estimating Group for Hazardous, Toxic, and Radiological Waste Remediation.

Included in the capital costs developed by RACER are estimates for professional labor to support the remedial action. This labor support is calculated based on the technology employed and includes construction oversight and preparation of work plans (e.g., health and safety, sampling, quality control). Indirect cost estimates for remedial actions include items such as sales tax on purchased items, contractors' overhead, contractors' profits, bonds, and insurance costs. Engineering, another indirect cost item, varies for each alternative depending on the complexity of the remedial action.

The cost estimates presented in this FS Report have an accuracy of +50 percent to -30 percent, consistent with U.S. EPA remedial investigation (RI) and FS technical guidance (U.S. EPA 1988). It is important to note that costs prepared at this stage of a remediation project can increase during final design and/or implementation. Such escalation is usually a result of scope changes that cannot be explicitly defined due to a lack of complete, accurate, and detailed information when the FS Report is prepared. Contingency allowances have therefore been added to the capital costs and operation and maintenance (O&M) costs at a rate of 20 percent to cover increases that may occur as a result of scope-related uncertainties.

B1.2 User-Defined Costs

It was not possible to develop RACER cost estimates for some elements of the alternatives because of certain site-specific or unique characteristics. The costs for these elements were estimated with quotes and other cost data from vendors, contractors, and previous cost estimates. These costs were evaluated and adjusted as necessary to account for inflation.

B1.3 Cost Estimate Components

Cost estimates for IR Site 24 remedial alternatives include capital costs, O&M costs, and contingency allowances. A description of each of these cost categories is provided below.

B1.3.1 CAPITAL COSTS

Capital costs consist of direct and indirect costs. Direct costs include expenditures incurred for equipment, labor, and materials needed to develop, construct, and implement a remedial action. Indirect costs include all other expenses necessary to support the construction that cannot be directly associated with a specific equipment item or remedial activity. Indirect costs include the following:

- health and safety items
- permitting and legal fees
- site supervision
- engineering
- contractor overhead and profit
- startup costs

These indirect expenditures are included in the detailed cost analysis, either as separate line items or as a percentage of the direct capital cost.

B1.3.2 OPERATION AND MAINTENANCE COSTS

O&M costs refer to those post-construction items necessary to assure the continued effectiveness of a remedial action. Typical O&M expenses include power, operating labor, consumable materials, purchased services (such as laboratory services), equipment replacement, maintenance, sampling of monitoring wells, permit fees, annual reports, and periodic site reviews.

B1.3.3 CONTINGENCY ALLOWANCES

Contingency allowances are assumed to be 20 percent of the cost of each alternative. Contingency allowances have been added to the FS cost estimates to account for uncertainties in project scope. The size of the contingency allowance would be expected to decrease as cost estimates are prepared during subsequent phases of design, after a remedial alternative has been selected and is proceeding toward implementation.

B1.4 Present Value

Present value is calculated using present worth analysis, a method of evaluating alternative remedial action solutions when expenditures occur over different time periods. The costs for the various remedial action alternatives can be compared on the basis of a single figure for each alternative by discounting all future costs to a common year. This single figure, the present value, represents the amount of money which, if invested in the initial year of a remedial action and disbursed as needed, would be sufficient to cover all costs associated with that alternative.

The present worth of expenditures occurring over the life of a remedial action is determined using the formula:

$$PW = \sum_{t=1}^{n} \frac{x_t}{(1+i)^t}$$

where

PW	=	present worth
x_t	=	escalated expenditures for the remedial action in year t (the escalation rate is assumed to be 0 percent per year for this FS)
i	=	annual interest or discount rate
t	=	number of years in which each expenditure occurs following start of construction
n	=	number of years following start of construction

The present value is calculated by adding the capital costs to the present worth of the O&M annual expenditures and periodic costs priced as of January 2007 (including contingency allowances). Because the alternatives may be completed at different times, the present value was calculated for each alternative on the basis of a real discount rate of 3.0 percent per year for Alternatives 2, 3, and 4; and 2.5 percent per year for Alternative 5 (using real discount rates [adjusted for inflation] from Office of Management and Budget Circular A-94 January 2007) (OMB 2007).

B1.5 General Assumptions

Assumptions that influence the cost of implementing remedial alternatives at IR Site 24 were based on general engineering practices and the requirements of RACER, when appropriate. The following general assumptions were used to develop cost estimates for each alternative in this FS Report.

- Total costs were calculated using a cost base of 2007 dollars.
- O&M costs would be incurred beginning in 2008 and continue thereafter as required by each alternative.
- IR Site 24 is accessible. Specialized equipment or services, with the exception of those described in this FS Report, would not be required.
- All operations would be conducted using U.S. EPA Level D protective clothing.
- No disposal of hazardous materials is included unless specified.
- Work plan and safety and health plan preparation, technical oversight during planning, and implementation of work are included in the cost for professional labor.
- Contingency allowances are 20 percent of capital costs, O&M costs, and periodic costs.

B2 COST ESTIMATE ASSUMPTIONS

This section identifies the site-specific assumptions and parameters used to estimate costs for Alternatives 2 through 5. A complete description of each alternative is provided in Section 6 of the FS Report. A summary of each alternative is included in this subsection with emphasis on items that affect the cost of the remedial action.

Table B-1 presents the major assumptions which influence costs for each alternative, including details about assumptions regarding groundwater sampling and analyses. Summaries of the cost estimates for the groundwater alternatives are presented in Tables B-2 through B-5. For comparison, a summary of the estimated costs for Alternatives 2 through 5 is presented in Table B-6.

B2.1 Alternative 2 – ICs

Alternative 2 would rely on institutional controls (ICs) to minimize disturbance and dispersion of impacted sediment from the area of ecological concern (AOEC) into the open-water area.

Under Alternative 2, ICs have been assumed for the purpose of this FS Report; however, the actual ICs to be implemented would be established in the record of decision (ROD) and subsequent remedial design/remedial action documentation.

ICs would be put in place at IR Site 24 to:

- prohibit disturbance of sediments in the AOEC, and

- prohibit removal of the wharf road (including land-use restriction/structure maintenance agreements) without prior approval from regulatory agencies and the Navy.

Section 4.3.2 of the FS Report discusses how the Navy would implement and maintain ICs.

The effectiveness of the ICs would be reviewed periodically as part of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) 5-year review process. For Alternative 2, it is assumed that five 5-year reviews would be prepared. A closeout report would be prepared at the end of the ICs program. Reviews would be documented in summary reports issued to appropriate regulatory agencies.

Time until remedial action objectives (RAOs) are achieved would not be known for this alternative. For cost-estimating purposes, ICs are assumed to be in place for 30 years.

B2.2 Alternative 3 – MNR With ICs

Alternative 3 would rely on natural recovery processes to continue to isolate impacted sediment and reduce ecological exposure to chemicals of concern (COCs) in sediment over time in the 18,000-square-foot AOEC. A long-term monitored natural recovery (MNR) program, including periodic reviews, would be implemented to confirm that natural processes (primarily sediment deposition) were occurring and to track remediation progress. ICs would be included that are similar to those described for Alternative 2, to prohibit disturbance of sediment in the AOEC and to prohibit actions that would interfere with the MNR activities. Once sediment monitoring results indicated that RAOs were achieved and that ICs were no longer warranted, the regulatory agencies and the Navy would determine whether the MNR program and ICs could be discontinued.

Alternative 3 includes the following components:

- a predesign investigation to define the extent of COCs in sediment at concentrations exceeding preliminary RGs
- a sediment monitoring program with periodic sampling to assess sediment quality over time
- ICs to prohibit disturbance of impacted sediment in the AOEC and actions that would interfere with MNR activities
- periodic reviews and reporting

For cost-estimating purposes, the duration of Alternative 3 is assumed to be 30 years.

The extent of COCs in sediment at concentrations exceeding preliminary RGs would be refined during the remedial design stage based on analytical results from the predesign investigation included as part of this alternative. The results of this predesign investigation would also serve as a baseline against which subsequent sediment monitoring results would be compared. The predesign investigation would be implemented as the first step in the remediation. This predesign investigation is assumed for FS purposes to consist of the following components.

- Develop and obtain agency approval of a work plan.
- Perform a bathymetric survey in the AOEC to determine initial depth to sediment surface.
- Establish 18 permanent sampling stations (Figure B-1) so that repeated surveys/sampling conducted during the MNR program can be accurately compared.
- Collect and analyze one homogenized sediment sample across the exposure interval at each of the 18 permanent locations to assess the extent of COCs in sediment.
- Collect and analyze a core sediment sample at each of nine locations across the sediment interval and calculate the sedimentation rate from chemical and bathymetric survey data at the AOEC.
- Collect an assumed four samples in areas with elevated cadmium for analysis to evaluate cadmium efflux from sediment into overlying water.

Alternative 3 assumes that natural sedimentation and attenuation processes would continue to occur at IR Site 24 to reduce ecological exposure in the AOEC. In general, natural recovery would rely primarily on long-term natural sedimentation and covering of impacted sediment. This natural capping process, which has been documented in Seaplane Lagoon, would form a protective barrier over the sediment at IR Site 24 that would minimize resuspension of impacted sediment and limit exposure of ecological receptors to contaminants. The actual sedimentation rate at IR Site 24 is currently unknown; the sedimentation rate at nearby IR Site 17 (Seaplane Lagoon) has been estimated at approximately 0.6 to 0.7 inch (1.5 to 1.7 cm) per year (Battelle 2005). The sedimentation rate at the AOEC at IR Site 24 is probably similar to that estimated for Seaplane Lagoon, but is conservatively assumed for FS purposes to be at least one-half of the sedimentation rate in Seaplane Lagoon (i.e., approximately 0.3 inch or 0.8 cm per year). During the natural recovery processes, metals would be expected to remain bound to sediment by forming stable metal-sulfide precipitates, and then to be covered by cleaner natural sediment. Natural aerobic and anaerobic biodegradation processes would be expected to reduce the concentrations, bioavailability, and toxicity of organic contaminants.

Under Alternative 3, an MNR program would be developed and implemented at the AOEC to confirm that natural processes were occurring and to track remediation progress. The MNR program would include periodic bathymetric surveys, surface water sampling and analysis, and sediment sampling and analysis. It is assumed that the sediment exposure interval for ecological receptors would be 0 to 10 inches. Sufficient sediment data are not currently available to predict the duration of the MNR program; however, using an assumed sedimentation rate of 0.3 inch per year, it is conservatively estimated that approximately 10 inches (25 cm) of fresh sediment would be deposited at the site in an approximately 33-year period. Therefore, for cost-estimating purposes, it is assumed that the duration of this alternative is 30 years.

For cost-estimating purposes, it is assumed that the MNR bathymetric survey, surface water sampling and analysis, and sediment sampling and analysis activities would be performed every 5 years for the duration of this alternative. The sampling locations and depth intervals are the same as described above. Sediment samples would be analyzed for metals, pesticides, polychlorinated biphenyls (PCBs), grain-size distribution, total organic carbon, and radionuclides. Surface water samples at the water-sediment interface at four locations would be collected and analyzed for cadmium. If the predesign investigation results for cadmium efflux analysis indicate potential risk, additional cadmium efflux sampling will be performed as part of the monitoring program. For FS purposes, it is assumed that 20 percent of samples would be collected and analyzed for quality assurance/quality control (QA/QC) for each sampling event. The MNR program would be reviewed and optimized based on the survey and analytical results. The final monitoring program would be developed in the remedial design stage.

ICs would be put in place at the AOEC for Alternative 3 until RAOs were achieved and the Navy and regulatory agencies agreed that the site no longer posed a potentially unacceptable ecological risk. The actual ICs to be implemented at the AOEC would be established in the ROD and subsequent remedial design/remedial action documentation. The scope of the ICs would be similar to that described for Alternative 2 (Section 6.3.1.1 of the FS Report), with the added objective of prohibiting the alteration, disturbance, or removal of monitoring stations during the remedial action.

For Alternative 3, it is assumed that the activities and findings of the predesign investigation would be summarized in the remedial design documentation. For the purposes of this FS Report, it is assumed that five 5-year reviews would be prepared pursuant to CERCLA Section 121 and the NCP requirements and a closeout report would be prepared at the end of the MNR program and ICs. Results of periodic monitoring would be reported in conjunction with the 5-year reviews. Reviews would be documented in summary reports issued to the regulatory agencies.

B2.3 Alternative 4 – Thin-Layer Capping With ICs

Alternative 4 consists of installation of a thin-layer cap over the impacted sediment in the AOEC at IR Site 24 where concentrations of COCs exceed preliminary RGs (Figure B-1). Thin-layer capping is a form of containment in-place and refers to placement of a cap over an *in situ* deposit of impacted sediment. The placement the cap at IR Site 24 would accelerate natural recovery processes by providing physical isolation of contaminated sediment in the AOEC from potential ecological receptors. In addition to thin-layer capping, Alternative 4 would also include ICs, which would be similar to those described for Alternative 3. A long-term monitoring program, including periodic reviews, would be implemented to verify that the thin-layer cap was performing as intended, and to track progress of natural recovery processes.

Alternative 4 is included based on the following assumptions regarding cap construction and performance.

- Propeller scour is not expected to be a significant design concern because the AOEC is located primarily beneath the wharf road and sediment disturbance by boat propellers is not expected to cause significant mobilization of contaminated sediment into the open-water area of IR Site 24.
- Erosion and wave action are not expected to have a significant adverse impact on cap performance. IR Site 24 is isolated by the breakwater, and the AOEC at the site is located in an area where these forces are not expected to mobilize cap components.
- No armoring of the cap is expected to be required. Armoring would be evaluated in the remedial design stage.
- Thin-layer capping is assumed to be performed by hydraulic means (using hoses) or using other equipment capable of accessing the AOEC beneath the wharf road.

Alternative 4 would include the following components:

- a predesign investigation to define the extent of COCs in sediment at concentrations exceeding preliminary RGs and to collect design information for use in cap design
- placement of a thin-layer cap
- ICs to prohibit disturbance of impacted sediment in the AOEC and/or damage to the cap
- sediment monitoring
- periodic reviews and reporting

For cost-estimating purposes, the duration of Alternative 4 is assumed to be 30 years.

The predesign investigation for Alternative 4 would be identical to the investigation described for Alternative 3, except that baseline sediment sampling would include 10 permanent sampling points and 30 temporary sampling stations (a total of 40 sampling locations) with collection of one sample per location to determine cap placement locations. The predesign investigation would be implemented as the first step in the remediation. No core sampling would be performed as part of Alternative 4. Figure B-1 presents the proposed sampling locations.

For Alternative 4, a thin-layer cap would be installed over the AOEC where concentrations of COCs in sediment exceed preliminary RGs. Various types of thin-layer cap materials might be selected by the Navy for implementation at the AOEC at IR Site 24. The cap design details would be determined in the remedial design stage.

For cost-estimating purposes, it is assumed that a thin-layer cap would include clean, washed sand placed over the existing sediment at the AOEC (Figure B-1). The thin-layer cap would be 10 to 12 inches thick over an assumed area of approximately 18,000 square feet. For cost-estimating purposes, a 12-inch-thick cap is assumed to account for variations in cap placement during implementation. A cap thickness of 10 to 12 inches (25 to 30 cm) is considered sufficient compared to a typical biologically active zone of 4 to 6 inches (10 to 15 cm) (Thoms et al. 1995). A preliminary thin-layer capping design is depicted on Figure B-2. No armoring of the cap is assumed to be necessary. An estimated 700 bank cubic yards (bcy) of cap material would be emplaced at the site using throwing conveyors or by hydraulic means. To reduce the transport of suspended sediment or cap material released during thin-layer capping activities, physical containment barriers such as silt curtains or screens would be used as necessary. Surface-water monitoring for turbidity would be performed during cap placement to ensure that capping operations did not disperse suspended sediment from the AOEC into the open-water area.

Before cap installation, the site would be assessed to identify the extent of debris in the cap area. Debris such as driftwood, trash, clothing, and other debris that has migrated into the area would be removed. Large debris such as concrete rubble and riprap would be left in place. No treatability tests or pilot-scale tests are included for this alternative.

ICs would be put in place under Alternative 4 until the regulatory agencies and the Navy agreed that ICs were no longer warranted. The actual ICs to be implemented at the AOEC would be established in the ROD and subsequent remedial design/remedial action documentation. The scope of the ICs would be similar to that described for Alternative 3, with the added objective of assessing cap performance to confirm that the cap is functioning as intended.

For Alternative 4, two types of monitoring would be included: construction monitoring and performance monitoring. These monitoring program elements would be developed in the remedial design phase.

Construction monitoring would be performed to confirm that the cap placement was consistent with design plans and specifications, and to verify that placement did not cause excessive disbursement of contaminated sediment outside of the AOEC. During construction, monitoring results would be used to identify modifications to design or construction techniques (if needed) and to accommodate any unavoidable field constraints. Construction monitoring would include interim and postconstruction cap material placement surveys to verify the thickness of the thin-layer cap across the AOEC.

Performance-monitoring elements of this alternative would be developed and implemented to ensure that the cap was not being eroded or significantly compromised by external forces (e.g., penetration by submerged aquatic vegetation, unexpected erosion due to tidal action or propeller scour, or excessive bioturbation). It would also include ongoing monitoring for possible recontamination of the cap surface and noncapped areas from these activities or other sources. Ten permanent location benchmarks would be established so that periodic surveys could be accurately compared. The performance-monitoring program is assumed for FS purposes to include bathymetric surveys and sampling of surface sediment for the following analyses: metals, pesticides, PCBs, and grain-size distribution. Surface water samples at the water-sediment interface at four locations would be collected and analyzed for cadmium. Assuming that the predesign investigation results for cadmium efflux analysis indicated potential risk, additional cadmium efflux sampling would be performed as part of the monitoring program. The actual monitoring program would be designed during the remedial design phase of the project. The monitoring program would be reviewed and optimized based on the survey and analytical results. For cost-estimating purposes, the monitoring activities are assumed to be performed every 5 years for the assumed 30-year period, with results reported in conjunction with 5-year review reports. For FS purposes, it is assumed that:

- QA/QC samples would be collected at a frequency of 20 percent,
- an off-site laboratory would conduct the chemical analyses, and
- the field parameters would be measured at the site using hand-held equipment.

For Alternative 4, it is assumed that the activities and findings of the predesign investigation would be summarized in the remedial design documentation. For the purposes of this FS Report, it is assumed that five 5-year reviews would be prepared pursuant to CERCLA Section 121 and the NCP requirements. A closeout report would be prepared in year 30. Reviews would be documented in summary reports issued to appropriate regulatory agencies.

Once sediment monitoring results indicated that the preliminary RGs had been reached or that ICs were no longer warranted, the regulatory agencies and the Navy would determine whether the ICs could be discontinued. For cost-estimating purposes, ICs are assumed to be in place for 30 years.

B2.4 Alternative 5 – Sediment Removal/Dredging

Alternative 5 is a removal option that would employ dredging or a similar technology to remove sediment with COC concentrations exceeding preliminary RGs in the AOEC

(Figure B-1). The removed sediment would be disposed in an off-site commercial or hazardous waste landfill. Removal of impacted sediment would be verified through confirmation sampling. After completion of sediment removal, no ICs or long-term O&M activities would be required. The assumed total duration of Alternative 5 is 1 year.

Alternative 5 assumes that dredging or other sediment removal techniques would effectively remove the contaminated sediment from the AOEC. This alternative is included based on the following assumptions regarding the sediment removal process.

- The area subject to sediment removal would be limited to the AOEC, as identified on Figure B-3.
- Methods described in this section are for cost-estimating purposes only. Specific field methods would be described in remedial design documents. Other sediment removal methods such as diver-assisted hydraulic dredging might also be considered.
- Because access under the wharf road is limited, a combination of sediment removal techniques may be required, such as conventional dredging equipment (e.g., Aquamog or similar equipment), diver-assisted hydraulic dredging, and/or other sediment removal methods.

Alternative 5 includes the following components:

- predesign investigation
- sediment removal/dredging
- off-site disposal
- confirmation sampling
- reporting

The predesign investigation for Alternative 5 would be identical to the investigation described for Alternative 4, except that two sediment samples (shallow and deep) would be collected from each of the 40 sampling locations to further assess the vertical extent of the impacted sediment before sediment removal. The predesign investigation would be implemented as the first step in the remediation.

Based on the RI results, COC concentrations exceeding preliminary RGs were reported in sediment at bottom depths ranging from 5 to 50 cm (or approximately 2 to 20 inches) below the sediment surface. Because absolute precision is difficult to achieve in subaqueous sediment removal, Alternative 5 assumes sediment removal at 1-foot intervals, with depths ranging from 1 to 2 feet below the sediment surface. To minimize the volume of sediment to be dredged (and still accomplish the mass removal desired for this alternative), the 18,000-square-foot AOEC was divided into four subareas with varying depths (Figure B-3). The proposed boundaries of the subareas were determined based on interpretation of COC concentrations reported for the sediment samples and the locations of the concrete/wooden pilings beneath the wharf road. During a site visit, the pilings were observed to be approximately 13 feet apart along the direction of the wharf road. Based on the proposed sediment removal areas and depths, the volume of impacted sediment is 1,000 bcy. With an over-dredge allowance of approximately 500 bcy, the estimated total volume of dredged sediment for FS purposes is 1,500 bcy. The final boundaries and depths of the sediment removal areas would be determined during the remedial design phase, based on interpretation of analytical results from the predesign investigation.

Mechanical dredging, hydraulic dredging, excavation, or a combination of these technologies could be used to remove sediment from the AOEC. Because of the limited access and work space under the wharf road, it is expected that fender piles along the quay wall would need to be removed to allow access. Sediment removal is assumed to be performed with small barge-mounted or pontoon-mounted mechanical dredging equipment west of the quay wall. East of the quay wall, a combination of sediment removal methods may be required, such as mechanical and hydraulic dredging and diver-assisted methods. Because of the small equipment, limited access, and tides, it is assumed that sediment removal would be a time-intensive process. Approximately 1 month of sediment removal operations (with a sediment removal production rate ranging from 50 bcy per day beneath the wharf road to 75 bcy per day in the portion of the AOEC west of the quay wall) is assumed for cost-estimating purposes. Final selection of the sediment removal methods and equipment would take place during the remedial design phase. To reduce the transport of resuspended sediment released during removal operations, physical containment barriers such as silt curtains or screens would be used as necessary. Surface water monitoring for turbidity would be performed to ensure that sediment removal operations did not disperse resuspended sediment from the AOEC into the open-water area. During the sediment removal operations, driftwood, trash, clothing, and other debris would be removed; however, large debris such as concrete rubble and riprap would be left in place.

Alternative 5 assumes that dredged sediment and debris would be placed on a barge moored along the quay wall in the vicinity of the AOEC, and allowed to dewater. Due to typical restrictions on liquids in landfills, the dredged material might have to be dewatered further on land before off-site transport and disposal. After the sediment and debris were sufficiently dewatered to be nonflowing, they would be transferred from the barge to temporary staging piles on land to allow further dewatering by evaporation near the AOEC (Figure B-3). To prevent unauthorized entry, a fence with signs would be installed around the area containing the staging piles. For FS purposes, it is assumed that the temporary staging piles would be constructed with lined perimeter barriers and bottom with a leachate collection system. Dredged material would be placed in thin layers, and mixing would be performed as needed to spread the wet dredged materials and accelerate evaporation. The sediment generally would not be completely dried, to prevent off-site migration of airborne particles, but would be dried sufficiently to pass the paint filter test (U.S. EPA Method 9095B) required by receiving landfills. The final location and construction details of the temporary staging piles would be determined during the remedial design phase.

Water from land-side dewatering is assumed to be minimal. The water would be allowed to evaporate, or would be collected into drums or a small aboveground storage tank and characterized before off-site disposal. For cost-estimating purposes, it is assumed that 5,000 gallons of water would be generated and disposed as nonhazardous waste. The final location and construction details of the temporary staging piles and the final disposition of water would be determined during the remedial design phase.

After a first pass of sediment removal to the desired depth had been completed, confirmation samples would be collected from the ten permanent sampling stations established during the predesign investigation and submitted to an off-site analytical laboratory for analysis of COCs (metals, pesticides, and PCBs). For FS purposes, it is assumed that 20 percent of the samples would be collected and analyzed for QA/QC. Analytical results would be reviewed to confirm whether COCs in remaining sediment exceeded preliminary RGs. For FS purposes, it is also assumed that only one mobilization would be required and that one round of confirmation sampling would be conducted under this alternative.

After sediment removal and confirmation sampling activities had been completed, clean, washed granular backfill material (sand or gravel) from an off-site source would be placed in the dredged area to maintain the stability of the pier and wharf road structures in the AOEC. Two bathymetric surveys would be performed: a survey before backfilling operations and a final survey after completion of backfilling operations.

Detailed design documents would be prepared during the remedial design phase (after the issuance of the final ROD). In addition to determining the final boundaries of the AOEC and selection of the sediment removal method, the design might incorporate information on the construction and stability of the structures (e.g., wharf road, quay wall, piers, foundations, and pilings) in and near the proposed sediment removal area. The design of additional supports to preserve structural stability of the wharf road during sediment removal operations, if required, would be considered in the detailed design stage. Portions of the quay wall and water pipelines in the vicinity of the AOEC would likely need to be removed temporarily to allow access for sediment removal/dredging equipment and a barge for storing removed sediment. Details of these activities would also be described in the design documents.

Dewatered sediment would be segregated, stockpiled, and characterized before off-site disposal. For FS purposes, it is assumed that 50 percent of the dredged volume would be managed as Class II nonhazardous waste, 25 percent would be classified as RCRA hazardous waste due to metal concentrations and would require stabilization to meet RCRA land-disposal restrictions, and 25 percent would be classified as California hazardous waste. These percentages were based on an evaluation of the concentrations of COCs in sediment in the AOEC. These percentages are assumptions based on existing data, and were used to estimate the off-site disposal costs of the dredged sediments. Actual percentages and volumes of dredged sediments classified as nonhazardous or hazardous waste will be determined after reviewing the analytical results of waste profile samples before off-site disposal. It is assumed that the debris would be classified as nonhazardous waste.

Wet sediment placed on the barge would be allowed to drain until the sediment was considered nonflowing, with water shunted back into the AOEC. Following this initial dewatering, the sediment from the barge would be transferred to temporary staging piles on land near the AOEC and allowed to further dewater. Water from land-side dewatering is assumed to be minimal. The water would be allowed to evaporate, or would be collected into drums or a small aboveground storage tank and characterized before off-site disposal. It is assumed that any water collected from the staging piles would be classified as nonhazardous waste. Final disposition of water would be determined during the remedial design phase.

After sediment removal had been completed in a given subarea, confirmation samples would be collected and submitted to an off-site analytical laboratory for analysis of COCs. Analytical results would be reviewed to confirm that impacted sediment with COC concentrations exceeding preliminary RGs had been removed from the AOEC. For FS purposes, it is assumed that only one round of confirmation sampling would be conducted under this alternative. The final confirmation sampling and analysis program would be developed during the remedial design stage.

For Alternative 5, it is assumed that the activities and findings of the predesign investigation would be summarized in the remedial design documentation. A remedial action closeout report would be prepared following the completion of the remediation activities. A 5-year review pursuant to CERCLA Section 121 and the NCP is required if the selected remedy allows contaminants to remain at the site above levels that would allow for unrestricted use of the site. Because the assumed total duration of this alternative is less than 5 years, a 5-year review is not included. However, the Navy would conduct a 5-year review for this site if the selected remedy was not completed within this time period.

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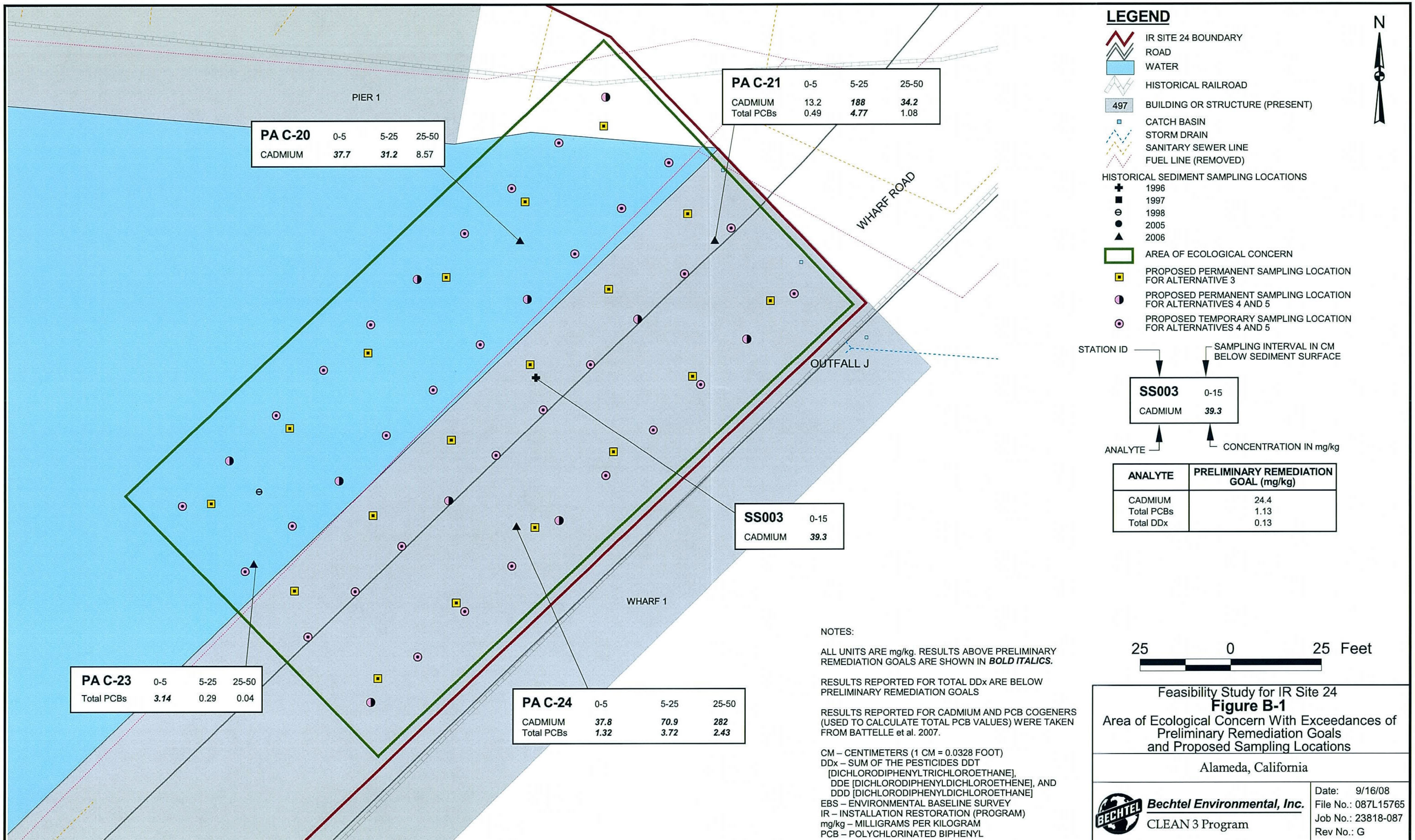
FIGURES



ANALYTE	PRELIMINARY REMEDIATION GOAL (mg/kg)
CADMIUM	24.4
Total PCBs	1.13
Total DDx	0.13

NOTES:

ALL UNITS ARE mg/kg. RESULTS ABOVE PRELIMINARY REMEDIATION GOALS ARE SHOWN IN ***BOLD ITALICS.***

RESULTS REPORTED FOR TOTAL DDx ARE BELOW PRELIMINARY REMEDIATION GOALS

RESULTS REPORTED FOR CADMIUM AND PCB COGENERS (USED TO CALCULATE TOTAL PCB VALUES) WERE TAKEN FROM BATTELLE et al. 2007.

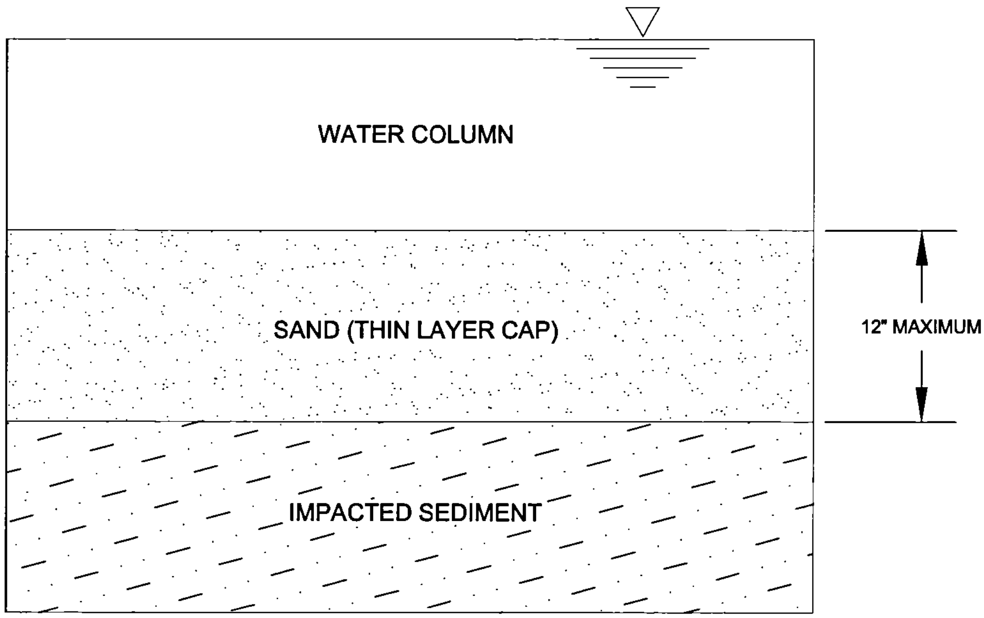
CM – CENTIMETERS (1 CM = 0.0328 FOOT)
DDx – SUM OF THE PESTICIDES DDT [DICHLORODIPHENYLTRICHLOROETHANE], DDE [DICHLORODIPHENYLDICHLOROETHENE], AND DDD [DICHLORODIPHENYLDICHLOROETHANE]
EBS – ENVIRONMENTAL BASELINE SURVEY
IR – INSTALLATION RESTORATION (PROGRAM)
mg/kg – MILLIGRAMS PER KILOGRAM
PCB – POLYCHLORINATED BIPHENYL

Feasibility Study for IR Site 24
Figure B-1
Area of Ecological Concern With Exceedances of Preliminary Remediation Goals and Proposed Sampling Locations

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 9/16/08
File No.: 087L15765
Job No.: 23818-087
Rev No.: G



NOTE:
IR – INSTALLATION RESTORATION (PROGRAM)

Feasibility Study for IR Site 24

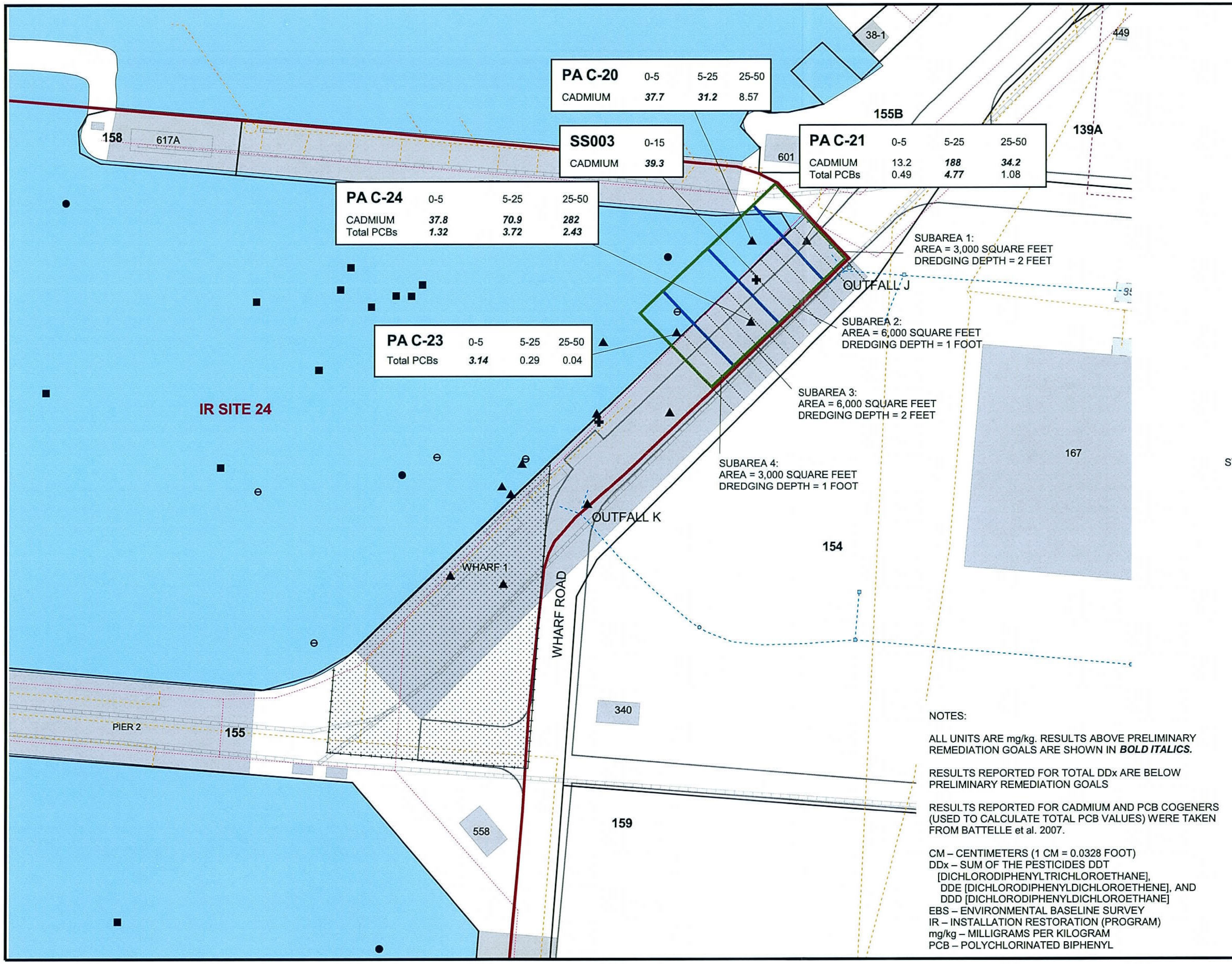
Figure B-2

Conceptual Design for Alternative 4
Thin-Layer Cap

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 9/27/07
File No: 087C15766
Job No: 23818-087
Rev No: D



ANALYTE	PRELIMINARY REMEDIATION GOAL (mg/kg)
CADMIUM	24.4
Total PCBs	1.13
Total DDx	0.13

NOTES:

ALL UNITS ARE mg/kg. RESULTS ABOVE PRELIMINARY REMEDIATION GOALS ARE SHOWN IN ***BOLD ITALICS.***

RESULTS REPORTED FOR TOTAL DDx ARE BELOW PRELIMINARY REMEDIATION GOALS

RESULTS REPORTED FOR CADMIUM AND PCB COGENERS (USED TO CALCULATE TOTAL PCB VALUES) WERE TAKEN FROM BATTELLE et al. 2007.

CM – CENTIMETERS (1 CM = 0.0328 FOOT)
DDx – SUM OF THE PESTICIDES DDT [DICHLORODIPHENYLTRICHLOROETHANE], DDE [DICHLORODIPHENYLDICHLOROETHENE], AND DDD [DICHLORODIPHENYLDICHLOROETHANE]
EBS – ENVIRONMENTAL BASELINE SURVEY
IR – INSTALLATION RESTORATION (PROGRAM)
mg/kg – MILLIGRAMS PER KILOGRAM
PCB – POLYCHLORINATED BIPHENYL

Feasibility Study for IR Site 24

Figure B-3

Conceptual Design for Alternative 5: Sediment Removal / Dredging

Alameda, California

Bechtel Environmental, Inc.
CLEAN 3 Program

Date: 9/16/08
File No.: 087L15767
Job No.: 23818-087
Rev No.: J

TABLES

Table B-1
Cost Estimate Assumptions for IR Site 24 Remedial Alternatives

ALTERNATIVE 2 – ICs	
Components	**Assumptions**
Remedial design	• 500 hours for preparation of the IC implementation plan
ICs	• Deed and covenant restrictions • Other activities (e.g., periodic drive-by) • No fencing and signage • $10,000 per year for ICs implementation • Duration of ICs is 30 years
Reviews and reports	• Reviews every 5 years (five review reports) • Project closeout report at end of year 30

Table B-1 (continued)

ALTERNATIVE 3 – MNR WITH ICs	
Components	**Assumptions**
Predesign investigation	• 500 hours for preparation of the work plan, SAP, and HASP • 18,000-square-foot remediation area • Sedimentation rate of approximately 0.3 inch per year • Sediment exposure interval is 0 to 10 inches; biologically active zone is 0 to 6 inches • Establish 18 permanent sampling stations (one station approximately every 1,000 square feet) so that repeated surveys/sampling can be accurately compared • Bathymetric survey ($15,000 lump sum) • Sediment sampling at the 18 permanent sampling stations. Samples to be collected at a depth interval of 0 to 6 inches below sediment surface and homogenized. For this initial sampling event, 18 samples would be collected for the following laboratory analyses: – metals (U.S. EPA 6010B/7000 Series) – pesticides (U.S. EPA 8081) – PCBs (U.S. EPA 8082) – grain-size distribution (ASTM C136-96 and D422-63) – total organic carbon (Walkley-Black) – 20% QA/QC samples • Sediment core sampling at nine locations across sediment exposure interval. Core samples to 10 inches below sediment surface. For this initial sampling event, nine core samples for the following laboratory analyses: – radionuclides (beryllium-7, lead-210, or cesium-137) ($500 per sample) – 20% QA/QC samples • Surface water sampling at four locations for cadmium efflux evaluation. Samples to be collected at the sediment-water interface. For this initial sampling event, four samples would be collected for the following laboratory analyses: – cadmium (U.S. EPA 6010B/7000 Series) – 20% QA/QC samples • Samples would be collected from a small craft/boat; no diving would be necessary • Twelve drums of IDW disposed of as nonhazardous waste; two drums for solid IDW and ten drums for liquid IDW • Two samples for waste profile analysis; analyze for metals, pesticides, and PCBs • 30-day TAT for laboratory analysis for sediment, surface water, and waste profile samples • No predesign investigation report; reporting of investigation results would be included in the remedial design documentation

Table B-1 (continued)

ALTERNATIVE 3 – MNR WITH ICs (continued)	
Components	**Assumptions**
Remedial design	• 700 hours for preparation of the monitoring plan, HASP, and IC implementation plan
ICs	• Scope and assumptions identical to those for Alternative 2, with the added objective of prohibiting the alteration, disturbance, or removal of monitoring stations during the remedial action
Sediment and surface water monitoring program	• Sediment monitoring every 5 years for 30 years • 18,000-square-foot remediation area • Bathymetric survey for each sampling event ($15,000 lump sum per event) • Sediment sampling at the 18 permanent sampling stations; sampling locations and depth interval as described above; analyze for metals, pesticides, PCBs, grain size distribution, and total organic carbon • Sediment core sampling at nine locations across sediment exposure interval; sampling locations, depth interval, and radionuclide analysis as described above • Surface water sampling at the water-sediment interface at four locations; analyze for cadmium (U.S. EPA 6010B/7000 Series) • Samples would be collected from a small craft/boat; no diving would be necessary • Twelve drums of IDW disposed of as nonhazardous waste for each monitoring event; two drums for solid IDW and 10 drums for liquid IDW • Two samples for waste profile analysis for each sampling event; analyze for metals, pesticides, and PCBs • 30-day TAT for laboratory analysis for sediment, surface water, and waste profile samples
Reviews and reports	• No predesign investigation report; reporting of investigation results would be included in the remedial design documentation • Reviews every 5 years for 30 years (five reports) • Project closeout report at end of year 30

Table B-1 (continued)

ALTERNATIVE 4 – THIN-LAYER CAPPING WITH ICs	
Components	**Assumptions**
Predesign investigation	• Scope and assumptions identical to those for Alternative 3, except as follows: – baseline sediment sampling would include 10 permanent sampling points and 30 temporary sampling points (a total of 40 sampling points) to determine cap placement locations – no sediment core sampling would be performed
Remedial design	• 1,500 hours for engineering and design and preparation of the monitoring plan, thin-layer capping design, HASP, and IC implementation plan
ICs	• Scope and assumptions identical to those for Alternative 3, with the added objective of assessing cap performance to confirm that the cap is functioning as intended.
Thin-layer capping	• Preconstruction and utility-locating survey (two persons for 1 week; includes report) • Two bathymetric surveys – baseline survey before and final survey after thin-layer capping installation • 2 weeks of mobe/demobe (estimated $50,000 lump sum cost estimate from Jerico Products [Lind, pers. com. 2007]) • 18,000-square-foot remediation area • Thin-layer capping would be performed in area where COCs exceed preliminary RGs (Figure 3-1 of the main FS Report) • Debris removal: driftwood, trash, clothing, and other debris that has migrated into the area would be removed (concrete rubble and riprap would be left in place) • Debris removal assumed to take 2 weeks for a crew of three divers plus a supervisor • 50-cy of debris disposed as nonhazardous waste • Thin-layer cap would be a layer of clean, washed sand placed on top of the existing sediment • Thin-layer cap thickness is 10 to 12 inches; estimated volume required is 700 bcy (for cost-estimating purposes, a 12-inch-thick cap was assumed to account for the variations in cap placement during implementation) • Thin-layer capping costs estimated from information provided by Jerico Products (Lind, pers. com. 2007) • Thin-layer capping will be performed by hydraulic means (using hoses) or using other equipment capable of accessing the AOEC beneath the wharf road, with a duration of approximately 6 weeks for capping • A silt screen or curtain around the remediation area would be used to contain all the particulates suspension during the capping activities • Suitable types and quantities of cap materials are readily available locally • Rental of a field trailer for 8 weeks • Water and electricity would be available on-site • Fencing and signage around the construction materials (400 linear feet) • Sediment monitoring and analyses post-treatment, as described below • Prepare implementation report

Table B-1 (continued)

ALTERNATIVE 4 – THIN-LAYER CAPPING WITH ICs (continued)	
Components	**Assumptions**
Sediment and surface water monitoring program	• Establish ten permanent sampling points so that repeated surveys/sampling can be accurately compared • Sediment monitoring every 5 years for 30 years • Bathymetric survey for each monitoring event ($15,000 lump sum per event) • Sediment at ten permanent locations would be sampled (one homogenized sample across the exposure interval at each location): – to confirm thin-layer cap construction and placement (one event), and – every 5 years for 30 years to monitor thin-layer cap performance (six events) • For surface water monitoring, collect ten open-water samples daily during the capping activities; use field equipment to measure turbidity • For each monitoring event, sediment samples would be submitted to an off-site laboratory for the following laboratory analyses: – metals (U.S. EPA 6010B/7000 Series) – pesticides (U.S. EPA 8081) – PCBs (U.S. EPA 8082) – grain-size distribution (ASTM C136-96 and D422-63) – 20% QA/QC samples • Surface water sampling at four locations for cadmium efflux evaluation. Samples to be collected at the sediment-water interface. For each monitoring event, four samples would be collected for the following laboratory analyses: – cadmium (U.S. EPA 6010B/7000 Series) – 20% QA/QC samples • Samples would be collected from a small craft/boat, no diving would be necessary • Two drums of IDW disposed of as nonhazardous waste for each monitoring event; one drum for solid IDW and one drum for liquid IDW • Two samples for waste profile analysis for each monitoring event; analyze for metals, pesticides, and PCBs • 2-day TAT for laboratory analyses for confirmation sampling event (year 1) • 30-day TAT for laboratory analyses for remediation progress monitoring events and waste profile sampling
Reviews and reports	• No predesign investigation report; reporting of investigation results would be included in the remedial design documentation • Implementation report • Reviews every 5 years (5 review reports) • Project closeout report at end of year 30

Table B-1 (continued)

ALTERNATIVE 5 – SEDIMENT REMOVAL/DREDGING	
Components	**Assumptions**
Predesign investigation	• Scope and assumptions identical to those for Alternative 4, except that sediment samples from the 40 sampling stations would be collected at the following two depth intervals to determine vertical extent of impacted sediment: 0–10 and 10–20 inches below sediment surface
Remedial design	• 1,500 hours for engineering and design and preparation of the sediment removal and disposal plan and the HASP
Sediment removal/dredging and disposal	• Preconstruction and utility-locating survey (two persons for 1 week; includes report) • 2 weeks of mobe/demobe (estimated $50,000 lump sum cost estimate from Jerico Products [Lind, pers. com. 2007]) • 11 weeks of sediment removal, backfilling, and disposal operations; actual sediment removal operations would take approximately 5 weeks, with a production rate ranging from 50 bcy per day beneath the wharf road to 75 bcy per day in the portion of the AOEC west of the quay wall • Water and electricity would be available on-site • 18,000-square-foot remediation area • Sediment removal would be performed in area where COCs exceed preliminary RGs • Remediation area divided into four subareas for sediment removal (Figure B-3), total volume is 1,000 bcy: – subarea 1: 3,000 square feet; depth of 2 feet – subarea 2: 6,000 square feet; depth of 1 foot – subarea 3: 6,000 square feet; depth of 2 feet – subarea 4: 3,000 square feet; depth of 1 foot With an over-dredge allowance of approximately 500 bcy, the total volume of dredged sediment is 1,500 bcy • Sediment removal costs estimated from information provided by Jerico Products (Lind, pers. com. 2007) • Sediment removal areas, depths, and volumes may change based on predesign investigation and confirmation sediment sampling results • Sediment removal to be performed using a limited-access mechanical dredging method with an enclosed "environmental" bucket with a silt screen or curtain around the area being dredged • Surface water monitoring to be performed to ensure that sediment removal and backfilling activities do not disperse suspended sediment or backfill material from work areas into the open water area; field analysis of turbidity using rented equipment • Removal and replacement of fender piles, cross members, and utility lines underneath the wharf performed before and after sediment removal; assumed to take 2 weeks • Debris removal performed before sediment removal: driftwood, trash, clothing, and other debris that has migrated into the area would be removed (large debris such as concrete rubble and riprap would be left in place) • Debris removal assumed to take 2 weeks • Two bathymetric surveys after sediment removal operations: survey before backfilling operations and final survey after backfilling operations ($15,000 lump sum per event)

Table B-1 (continued)

<table>
<tr><th colspan="2">ALTERNATIVE 5 – SEDIMENT REMOVAL/DREDGING (continued)</th></tr>
<tr><th>Components</th><th>Assumptions</th></tr>
<tr><td>Sediment removal/dredging and disposal (continued)</td><td>
• Backfill with purchased clean, washed granular sand from a local source
• Dredged sediment to be placed on a barge and allowed to dewater, then transferred to temporary staging piles on land near the AOEC (Figure B-3) for further dewatering, if needed
– Construction and deconstruction of 4-foot-high, lined perimeter barriers and lined bottom with a leachate collection system for temporary staging piles; fencing and signage around the temporary staging piles
– Volume of water from land-side dewatering is 5,000 gallons
– Transfer and store water in an approximately 5,000-gallon aboveground tank
– Water to be characterized and disposed as nonhazardous waste
• Dewatered sediment would be segregated, stockpiled, and characterized before off-site disposal
– Approximately 50 percent (750 bcy) is assumed to be nonhazardous waste going to the Class II landfill at Altamont, Livermore, California, or similar facility
– Approximately 25 percent (375 bcy) is assumed to be RCRA-characteristic hazardous waste (due to metals concentrations) to be treated by stabilization at the Chemical Waste Management's hazardous waste landfill in Kettleman City, California (200 miles away) or similar facility
– Approximately 25 percent (375 bcy) is assumed to be California-characteristic hazardous waste going to the Chemical Waste Management's hazardous waste landfill in Kettleman City, California (200 miles away) or similar facility
• Waste transportation and disposal costs from local waste company
– $63 per bcy for nonhazardous waste, including transportation to the Class II landfill at Altamont, Livermore, California, or similar facility; disposal; and landfill taxes
– $329 per bcy for RCRA-characteristic hazardous waste, including transportation to the Chemical Waste Management's hazardous waste landfill in Kettleman City, California (200 miles away) or similar facility; stabilization; disposal; and landfill taxes
– $147 per bcy for California-characteristic hazardous waste, including transportation to the Chemical Waste Management's hazardous waste landfill in Kettleman City, California (200 miles away) or similar facility; disposal; and landfill taxes
• Waste disposal cost estimates as provided by NRC Environmental (Lodge, pers. com. 2007)
• 50 cy of debris disposed of as nonhazardous waste
• Equipment and temporary staging piles would be stored near the AOEC; estimated 600 linear feet of temporary fence installed around the area
• For sediment, collect six samples for waste profile analysis for metals, pesticides, and PCBs
• For water from land-side dewatering operations, one sample for waste profile analysis for metals, pesticides, and PCBs would be collected
• 30-day TAT for waste profile analysis
• Reporting of sediment removal and disposal activities would be included in the closeout report
</td></tr>
</table>

Table B-1 (continued)

ALTERNATIVE 5 – SEDIMENT REMOVAL/DREDGING (continued)	
Components	**Assumptions**
Confirmation sediment sampling and analysis; surface water monitoring program	• One round of confirmation sediment sampling and analysis to confirm all sediment with concentrations of COCs above the preliminary RGs have been removed • Sediment sampling at the ten permanent sampling stations (see above and Alternative 4, predesign investigation) at two depth intervals: 0–10 and 10–20 inches below sediment surface; for the confirmation sampling event, 20 samples for the following laboratory analyses: – metals (U.S. EPA 6010B/7000 Series) – pesticides (U.S. EPA 8081) – PCBs (U.S. EPA 8082) – 20% QA/QC samples • 2-day TAT for laboratory analysis • For surface water monitoring, collect ten open-water samples daily during the sediment removal and backfilling activities. Use field equipment to measure turbidity • Samples would be collected from a small craft/boat; no diving would be necessary • IDW generated during confirmation sampling activities would be combined with dredged sediment and water from land-side dewatering operation
Reviews and reports	• No predesign investigation report; reporting of investigation results would be included in the remedial design documentation • Assumed total duration is 1 year; 5-year reviews not required • Project closeout report at end of year 1

Acronyms/Abbreviations:
- AOEC – area of ecological concern
- ASTM – American Society for Testing and Materials
- bcy – bank cubic yard
- COC – chemical of concern
- cy – cubic yard
- FS – feasibility study
- HASP – health and safety plan
- IC – institutional control
- IDW – investigation-derived waste
- IR – Installation Restoration (Program)
- MNR – monitored natural recovery
- mobe/demobe – mobilization/demobilization
- PCB – polychlorinated biphenyl
- RG – remediation goal
- QA – quality assurance
- QC – quality control
- RCRA – Resource Conservation and Recovery Act
- SAP – sampling and analysis plan
- SIM – selected ion monitoring
- TAT – turnaround time
- U.S. EPA – United States Environmental Protection Agency

Table B-2
Detailed Cost Estimate Summary for Alternative 2: ICs

Description	Calendar Year 1 2008	Calendar Year 2 2009	Calendar Year 3 2010	Calendar Year 4 2011	Calendar Year 5 2012	Calendar Year 6 2013	Calendar Year 7 2014	Calendar Year 8 2015	Calendar Year 9 2016	Calendar Year 10 2017	Calendar Year 11 2018	Calendar Year 12 2019	Calendar Year 13 2020	Calendar Year 14 2021	Calendar Year 15 2022
CAPITAL COSTS															
Remedial design (500 hrs)	$50,000														
O&M COSTS															
Institutional controls (30 years)	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000
5-year reviews (300 hrs x $100/hr)					$30,000					$30,000					$30,000
Closeout report															
Subtotal (With Markups)[a]	$60,000	$10,000	$10,000	$10,000	$40,000	$10,000	$10,000	$10,000	$10,000	$40,000	$10,000	$10,000	$10,000	$10,000	$40,000
Contingency (20%)	$12,000	$2,000	$2,000	$2,000	$8,000	$2,000	$2,000	$2,000	$2,000	$8,000	$2,000	$2,000	$2,000	$2,000	$8,000
Subtotal (With Contingency and Markups)[a]	$72,000	$12,000	$12,000	$12,000	$48,000	$12,000	$12,000	$12,000	$12,000	$48,000	$12,000	$12,000	$12,000	$12,000	$48,000
Escalation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Cost	$72,000	$12,000	$12,000	$12,000	$48,000	$12,000	$12,000	$12,000	$12,000	$48,000	$12,000	$12,000	$12,000	$12,000	$48,000
NET PRESENT VALUE FACTOR	0.970874	0.942596	0.915142	0.888487	0.862609	0.837484	0.813092	0.789409	0.766417	0.744094	0.722421	0.701380	0.680951	0.661118	0.641862
NET PRESENT VALUE[b]	$69,903	$11,311	$10,982	$10,662	$41,405	$10,050	$9,757	$9,473	$9,197	$35,717	$8,669	$8,417	$8,171	$7,933	$30,809

Description	Calendar Year 16 2023	Calendar Year 17 2024	Calendar Year 18 2025	Calendar Year 19 2026	Calendar Year 20 2027	Calendar Year 21 2028	Calendar Year 22 2029	Calendar Year 23 2030	Calendar Year 24 2031	Calendar Year 25 2032	Calendar Year 26 2033	Calendar Year 27 2034	Calendar Year 28 2035	Calendar Year 29 2036	Calendar Year 30 2037	Row Total
CAPITAL COSTS																
Remedial design (500 hrs)																$50,000
O&M COSTS																
Institutional controls (30 years)	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$300,000
5-year reviews (300 hrs x $100/hr)					$30,000					$30,000						$150,000
Closeout report															$30,000	$30,000
Subtotal (With Markups)[a]	$10,000	$10,000	$10,000	$10,000	$40,000	$10,000	$10,000	$10,000	$10,000	$40,000	$10,000	$10,000	$10,000	$10,000	$40,000	$530,000
Contingency (20%)	$2,000	$2,000	$2,000	$2,000	$8,000	$2,000	$2,000	$2,000	$2,000	$8,000	$2,000	$2,000	$2,000	$2,000	$8,000	$106,000
Subtotal (With Contingency and Markups)[a]	$12,000	$12,000	$12,000	$12,000	$48,000	$12,000	$12,000	$12,000	$12,000	$48,000	$12,000	$12,000	$12,000	$12,000	$48,000	$636,000
Escalation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Cost	$12,000	$12,000	$12,000	$12,000	$48,000	$12,000	$12,000	$12,000	$12,000	$48,000	$12,000	$12,000	$12,000	$12,000	$48,000	$636,000
NET PRESENT VALUE FACTOR	0.623167	0.605016	0.587395	0.570286	0.553676	0.537549	0.521893	0.506692	0.491934	0.477606	0.463695	0.450189	0.437077	0.424346	0.411987	
NET PRESENT VALUE[b]	$7,478	$7,260	$7,049	$6,843	$26,576	$6,451	$6,263	$6,080	$5,903	$22,925	$5,564	$5,402	$5,245	$5,092	$19,775	$426,362

Notes:
[a] markups include general conditions consisting of overall project management, overhead, bonds and insurance, home office support, taxes, and profit
[b] the present value is calculated by adding the capital costs to the present worth of the O&M annual expenditures and periodic costs priced as of January 2007 (including contingency allowances); because the tasks may be completed at different times, the present value was calculated on the basis of real discount rate; for this cost estimate report, a discount rate of 3.0 percent was used

Acronyms/Abbreviations:
hr – hour
IC – institutional control
O&M – operation and maintenance

Table B-3
Detailed Cost Estimate Summary for Alternative 3: MNR With ICs

Description	Calendar Year 1 2008	Calendar Year 2 2009	Calendar Year 3 2010	Calendar Year 4 2011	Calendar Year 5 2012	Calendar Year 6 2013	Calendar Year 7 2014	Calendar Year 8 2015	Calendar Year 9 2016	Calendar Year 10 2017
CAPITAL COSTS										
Predesign work plan and documentation (500 hrs)	$50,000									
Predesign investigation										
Bathymetric survey	$15,000									
Sampling crew and equipment	$47,900									
Sediment and surface water sampling	$48,064									
Waste profile and disposal	$3,402									
Remedial design (700 hrs)	$70,000									
O&M COSTS										
Bathymetric survey (every 5 years for 30 years)					$15,000					$15,000
Long-term monitoring (every 5 years for 30 years)					$95,318					$95,318
Institutional controls (30 years)	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000
5-year reviews (300 hrs x $100/hr)					$30,000					$30,000
Closeout report										
Subtotal (With Markups)[a]	$244,366	$10,000	$10,000	$10,000	$150,318	$10,000	$10,000	$10,000	$10,000	$150,318
Contingency (20%)	$48,873	$2,000	$2,000	$2,000	$30,064	$2,000	$2,000	$2,000	$2,000	$30,064
Subtotal (With Contingency and Markups)[a]	$293,239	$12,000	$12,000	$12,000	$180,382	$12,000	$12,000	$12,000	$12,000	$180,382
Escalation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Cost	$293,239	$12,000	$12,000	$12,000	$180,382	$12,000	$12,000	$12,000	$12,000	$180,382
NET PRESENT VALUE FACTOR	0.970874	0.942596	0.915142	0.888487	0.862609	0.837484	0.813092	0.789409	0.766417	0.744094
NET PRESENT VALUE[b]	$284,698	$11,311	$10,982	$10,662	$155,599	$10,050	$9,757	$9,473	$9,197	$134,221

Description	Calendar Year 11 2018	Calendar Year 12 2019	Calendar Year 13 2020	Calendar Year 14 2021	Calendar Year 15 2022	Calendar Year 16 2023	Calendar Year 17 2024	Calendar Year 18 2025	Calendar Year 19 2026	Calendar Year 20 2027
CAPITAL COSTS										
Predesign work plan and documentation (500 hrs)										
Predesign investigation										
Bathymetric survey										
Sampling crew and equipment										
Sediment and surface water sampling										
Waste profile and disposal										
Remedial design (700 hrs)										
O&M COSTS										
Bathymetric survey (every 5 years for 30 years)					$15,000					$15,000
Long-term monitoring (every 5 years for 30 years)					$95,318					$95,318
Institutional controls (30 years)	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000
5-year reviews (300 hrs x $100/hr)					$30,000					$30,000
Closeout report										
Subtotal (With Markups)[a]	$10,000	$10,000	$10,000	$10,000	$150,318	$10,000	$10,000	$10,000	$10,000	$150,318
Contingency (20%)	$2,000	$2,000	$2,000	$2,000	$30,064	$2,000	$2,000	$2,000	$2,000	$30,064
Subtotal (With Contingency and Markups)[a]	$12,000	$12,000	$12,000	$12,000	$180,382	$12,000	$12,000	$12,000	$12,000	$180,382
Escalation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Cost	$12,000	$12,000	$12,000	$12,000	$180,382	$12,000	$12,000	$12,000	$12,000	$180,382
NET PRESENT VALUE FACTOR	0.722421	0.701380	0.680951	0.661118	0.641862	0.623167	0.605016	0.587395	0.570286	0.553676
NET PRESENT VALUE[b]	$8,669	$8,417	$8,171	$7,933	$115,780	$7,478	$7,260	$7,049	$6,843	$99,873

Description	Calendar Year 21 2028	Calendar Year 22 2029	Calendar Year 23 2030	Calendar Year 24 2031	Calendar Year 25 2032	Calendar Year 26 2033	Calendar Year 27 2034	Calendar Year 28 2035	Calendar Year 29 2036	Calendar Year 30 2037	Row Total
CAPITAL COSTS											
Predesign work plan and documentation (500 hrs)											$50,000
Predesign investigation											
Bathymetric survey											$15,000
Sampling crew and equipment											$47,900
Sediment and surface water sampling											$48,064
Waste profile and disposal											$3,402
Remedial design (700 hrs)											$70,000
O&M COSTS											
Bathymetric survey (every 5 years for 30 years)					$15,000					$15,000	$90,000
Long-term monitoring (every 5 years for 30 years)					$95,318					$95,318	$571,908
Institutional controls (30 years)	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$300,000
5-year reviews (300 hrs x $100/hr)					$30,000						$150,000
Closeout report										$30,000	$30,000
Subtotal (With Markups)[a]	$10,000	$10,000	$10,000	$10,000	$150,318	$10,000	$10,000	$10,000	$10,000	$150,318	$1,376,274
Contingency (20%)	$2,000	$2,000	$2,000	$2,000	$30,064	$2,000	$2,000	$2,000	$2,000	$30,064	$275,257
Subtotal (With Contingency and Markups)[a]	$12,000	$12,000	$12,000	$12,000	$180,382	$12,000	$12,000	$12,000	$12,000	$180,382	$1,651,531
Escalation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Cost	$12,000	$12,000	$12,000	$12,000	$180,382	$12,000	$12,000	$12,000	$12,000	$180,382	$1,651,531
NET PRESENT VALUE FACTOR	0.537549	0.521893	0.506692	0.491934	0.477606	0.463695	0.450189	0.437077	0.424346	0.411987	
NET PRESENT VALUE[b]	$6,451	$6,263	$6,080	$5,903	$86,151	$5,564	$5,402	$5,245	$5,092	$74,315	$1,129,889

Notes:
[a] markups include general conditions consisting of overall project management, overhead, bonds and insurance, home office support, taxes, and profit
[b] the present value is calculated by adding the capital costs to the present worth of the O&M annual expenditures and periodic costs priced as of January 2007 (including contingency allowances); because the tasks may be completed at different times, the present value was calculated on the basis of real discount rate; for this cost estimate report, a discount rate of 3.0 percent was used

Acronyms/Abbreviations:
hr – hour
IC – institutional control
MNR – monitored natural recovery
O&M – operation and maintenance

Table B-4
Detailed Cost Estimate Summary for Alternative 4: Thin-Layer Capping With ICs

Description	Calendar Year 1 2008	Calendar Year 2 2009	Calendar Year 3 2010	Calendar Year 4 2011	Calendar Year 5 2012	Calendar Year 6 2013	Calendar Year 7 2014	Calendar Year 8 2015	Calendar Year 9 2016	Calendar Year 10 2017	Calendar Year 11 2018	Calendar Year 12 2019	Calendar Year 13 2020	Calendar Year 14 2021	Calendar Year 15 2022	Calendar Year 16 2023	Calendar Year 17 2024	Calendar Year 18 2025	Calendar Year 19 2026	Calendar Year 20 2027	Calendar Year 21 2028	Calendar Year 22 2029	Calendar Year 23 2030	Calendar Year 24 2031	Calendar Year 25 2032	Calendar Year 26 2033	Calendar Year 27 2034	Calendar Year 28 2035	Calendar Year 29 2036	Calendar Year 30 2037	Row Total
CAPITAL COSTS																															
Predesign work plan and documentation (500 hrs)	$50,000																														$50,000
Predesign investigation																															
Utility locating	$12,000																														$12,000
Bathymetric survey	$15,000																														$15,000
Sampling crew and equipment	$82,184																														$82,184
Sediment and surface water sampling	$78,740																														$78,740
Waste profile and disposal	$3,335																														$3,335
Remedial design (1,500 hrs)	$150,000																														$150,000
Thin-layer capping implementation																															
Debris removal	$154,825																														$154,825
Thin-layer cap installation	$520,351																														$520,351
Open water monitoring during construction	$38,653																														$38,653
Confirmation sampling	$63,887																														$63,887
Bathymetric survey	$15,000																														$15,000
Thin-layer capping implementation report (200 hrs)	$20,000																														$20,000
O&M COSTS																															
Bathymetric survey (every 5 years for 30 years)					$15,000					$15,000					$15,000					$15,000					$15,000					$15,000	$90,000
Long-term monitoring (every 5 years for 30 years)					$47,438					$47,438					$47,438					$47,438					$47,438					$47,438	$284,628
Institutional controls (30 years)	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$300,000
5-year reviews (300 hrs x $100/hr)					$30,000					$30,000					$30,000					$30,000					$30,000						$150,000
Closeout report																														$30,000	$30,000
Subtotal (With Markups)[a]	$1,213,975	$10,000	$10,000	$10,000	$102,438	$10,000	$10,000	$10,000	$10,000	$102,438	$10,000	$10,000	$10,000	$10,000	$102,438	$10,000	$10,000	$10,000	$10,000	$102,438	$10,000	$10,000	$10,000	$10,000	$102,438	$10,000	$10,000	$10,000	$10,000	$102,438	$2,058,603
Contingency (20%)	$242,795	$2,000	$2,000	$2,000	$20,488	$2,000	$2,000	$2,000	$2,000	$20,488	$2,000	$2,000	$2,000	$2,000	$20,488	$2,000	$2,000	$2,000	$2,000	$20,488	$2,000	$2,000	$2,000	$2,000	$20,488	$2,000	$2,000	$2,000	$2,000	$20,488	$411,723
Subtotal (With Contingency and Markups)[a]	$1,456,770	$12,000	$12,000	$12,000	$122,926	$12,000	$12,000	$12,000	$12,000	$122,926	$12,000	$12,000	$12,000	$12,000	$122,926	$12,000	$12,000	$12,000	$12,000	$122,926	$12,000	$12,000	$12,000	$12,000	$122,926	$12,000	$12,000	$12,000	$12,000	$122,926	$2,470,326
Escalation	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Cost	$1,456,770	$12,000	$12,000	$12,000	$122,926	$12,000	$12,000	$12,000	$12,000	$122,926	$12,000	$12,000	$12,000	$12,000	$122,926	$12,000	$12,000	$12,000	$12,000	$122,926	$12,000	$12,000	$12,000	$12,000	$122,926	$12,000	$12,000	$12,000	$12,000	$122,926	$2,470,326
NET PRESENT VALUE FACTOR	0.970874	0.942596	0.915142	0.888487	0.862609	0.837484	0.813092	0.789409	0.766417	0.744094	0.722421	0.701380	0.680951	0.661118	0.641862	0.623167	0.605016	0.587395	0.570286	0.553676	0.537549	0.521893	0.506692	0.491934	0.477606	0.463695	0.450189	0.437077	0.424346	0.411987	
NET PRESENT VALUE[b]	$1,414,340	$11,311	$10,982	$10,662	$106,037	$10,050	$9,757	$9,473	$9,197	$91,468	$8,669	$8,417	$8,171	$7,933	$78,902	$7,478	$7,260	$7,049	$6,843	$68,061	$6,451	$6,263	$6,080	$5,903	$58,710	$5,564	$5,402	$5,245	$5,092	$50,644	$2,047,414

Notes:

[a] markups include general conditions consisting of overall project management, overhead, bonds and insurance, home office support, taxes, and profit

[b] the present value is calculated by adding the capital costs to the present worth of the O&M annual expenditures and periodic costs priced as of January 2007 (including contingency allowances); because the tasks may be completed at different times, the present value was calculated on the basis of real discount rate; for this cost estimate report, a discount rate of 3.0 percent was used

Acronyms/Abbreviations:
hr – hour
IC – institutional control
O&M – operation and maintenance

Table B-5
Detailed Cost Estimate Summary for Alternative 5: Sediment Removal/Dredging

Description	Calendar Year 1	Total
	2008	
CAPITAL COSTS		
Predesign work plan and documentation (500 hrs)	$50,000	$50,000
Predesign investigation		
Utility locating	$12,000	$12,000
Bathymetric survey	$15,000	$15,000
Sampling crew and equipment	$79,087	$79,087
Sediment and surface water sampling	$159,630	$159,630
Waste profile and disposal	$3,209	$3,209
Remedial design (1,500 hrs)	$150,000	$150,000
Sediment removal/dredging implementation		
Debris removal	$154,825	$154,825
Construct/remove stockpile area	$103,238	$103,238
Sediment removal/dredging	$1,366,117	$1,366,117
Open water monitoring during sediment removal/dredging	$35,424	$35,424
Confirmation sampling	$81,929	$81,929
Bathymetric survey (one before and one after sediment removal/dredging)	$30,000	$30,000
Stage sediment for disposal	$18,392	$18,392
Waste profile	$10,211	$10,211
Disposal off-site	$235,039	$235,039
Removal and replacement of fender piles, cross members, and utility lines	$285,000	$285,000
Sediment removal/dredging implementation and closeout report (500 hrs)	$50,000	$50,000
O&M COSTS (Not Required)		
Subtotal (With Markups)[a]	**$2,839,101**	**$2,839,101**
Contingency (20%)	$567,820	$567,820
Subtotal (With Contingency and Markups)[a]	**$3,406,921**	**$3,406,921**
Escalation	$0	$0
Total Cost	**$3,406,921**	**$3,406,921**
NET PRESENT VALUE FACTOR	0.975610	
NET PRESENT VALUE[b]	**$3,323,825**	**$3,323,825**

Notes:

[a] markups include general conditions consisting of overall project management, overhead, bonds and insurance, home office support, taxes, and profit

[b] the present value is calculated by adding the capital costs to the present worth of the O&M annual expenditures and periodic costs priced as of January 2007 (including contingency allowances); because the tasks may be completed at different times, the present value was calculated on the basis of real discount rate; for this cost estimate report, a discount rate of 2.5 percent was used

Acronyms/Abbreviations:
hr – hour
O&M – operation and maintenance

Table B-6
Summary of Cost Estimates for IR Site 24 Remedial Alternatives

Alternative	Duration of Alternative	Capital Cost	O&M Cost	Total Cost[a]	Net Present Value[b]
2 – ICs	30 years	$50,000	$480,000	$636,000	$426,000
3 – MNR with ICs	30 years	$234,000	$1,142,000	$1,651,000	$1,130,000
4 – thin-layer capping with ICs	30 years	$1,204,000	$855,000	$2,470,000	$2,047,000
5 – sediment removal/dredging	1 year	$2,839,000	$0	$3,407,000	$3,324,000

Note:
[a] the total cost includes contingency allowances
[b] a discount rate of 3.0 percent per year was used to calculate the net present values for Alternatives 2, 3, and 4, and a discount rate of 2.5 percent per year was used to calculate the net present value for Alternative 5 (OMB 2007)

Acronyms/Abbreviations:
IC – institutional control
IR – Installation Restoration (Program)
MNR – monitored natural recovery
O&M – operation and maintenance

APPENDIX C

RESPONSES TO AGENCY COMMENTS

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RESPONSE TO COMMENTS FROM U.S. EPA ON DRAFT FS REPORT

RESPONSE TO COMMENTS ON
DRAFT FEASIBILITY STUDY REPORT, IR SITE 24
ALAMEDA POINT, ALAMEDA, CALIFORNIA
DATED NOVEMBER 2007
BEI-7526-0087-0032

Comments from U.S. EPA, Xuan-Mai Tran 2/27/2008

GENERAL COMMENTS	RESPONSE TO GENERAL COMMENTS
General Comment 1. Alternative 2, Institutional Controls (ICs) of the Draft Feasibility Study Report, IR Site 24 (the FS Report), assumes that natural processes will accomplish ecological risk reduction with time; however, it is unclear how this alternative would be effective for ecological receptors since none of the legal and administrative controls described in Section 4.3.2 are effective for ecological receptors. Also, it is unclear how the effectiveness of the natural processes will be evaluated to determine if ecological risk at Site 24 has been minimized without monitoring. While ICs would be effective as an interim strategy with other remedial process options, it is unclear how it is a stand-alone remedy. Please include additional information in the FS Report to detail how natural processes will accomplish ecological risk reduction with time and how this will be determined or revise the text in Sections 5, 6, and on Tables 5-2 and 6-1 to clarify that ICs are not effective for ecological receptors. Also, please revise the text and Tables 5-2 and 6-1 to clarify that natural recovery cannot be assumed for Alternative 2 because there is no monitoring to verify this process.	**Response to General Comment 1.** The discussion of Alternative 2 was revised so that natural recovery is not considered part of the process. While natural recovery processes may occur, without a means to monitor the processes, they should not be relied upon. ICs are an effective means of managing sediment disturbance at the AOEC at IR Site 24. If subsurface sediment with elevated concentrations of COCs is distributed throughout a larger portion of IR Site 24, the ecological risk would be expected to increase. Since the risk estimates presented in the RI Report indicated that the potential ecological risk was not great (individual HQs not greatly exceeding 1), ICs would be effective at prohibiting subsurface sediment from causing greater risk. The ICs described for Alternatives 2 through 4 are not intended to reduce ecological risk at IR Site 24. As stated above, ICs are intended to prevent disturbance and dispersion of impacted sediment, thus preventing increases in ecological exposure that could occur from spreading of impacted sediment beyond the AOEC. The FS presents a range of alternatives for consideration by decision makers in the remedy selection process. Alternative 2 represents the least active of the active alternatives, and would only be selected if risk management decision makers decided that risks did not warrant a more active remedy. References to natural recovery processes in the description and evaluation of Alternative 2 have been deleted from the executive summary; Sections 5.1.2, 6.3, 6.3.2.1, 6.3.2.3, and 6.3.2.5; Table 5-2; and Table 6-1. Please refer also to the Responses to Specific Comments 15 and 16.
General Comment 2. Section 4.3.5, Containment, states that, "For IR Site 24, cap armoring would not be necessary for protection against erosional forces due to the absence of strong currents, boat wakes, propeller scour, and large-boat anchoring;" however, page ES-1 states that, "Under the proposed future reuse plan, IR Site 24 will be	**Response to General Comment 2.** As stated in Section 6.5.1, no armoring of the thin-layer cap (for Alternative 4) is expected to be required based on the following assumptions. The text further specifies that the need for armoring would be further evaluated in the remedial design stage if Alternative 4 is selected as the preferred remedy.

GENERAL COMMENTS	RESPONSE TO GENERAL COMMENTS
General Comment 2 (continued). developed as a commercial marina along with the adjacent Seaplane Lagoon; there are currently no plans to remove the piers." It is unclear why cap armoring would not be necessary for protection against erosional forces when under the proposed future reuse plan, IR Site 24 will be developed as a commercial marina. Please revise the FS Report to clarify why IR Site 24 will not require protection from erosional forces from strong currents, boat wakes, propeller scour, and large-boat anchoring or to include cap armoring.	**Response to General Comment 2 (continued).** • Propeller scour is not expected to be a significant design concern because the AOEC is primarily under the wharf road and sediment disturbance by boat propellers is not expected to cause significant mobilization of contaminated sediment into the open-water area of IR Site 24. • Erosion and wave action are not expected to have a significant adverse impact on cap performance. Seaplane Lagoon and IR Site 24 are isolated by the breakwater (shown on Figure 1-2 of the FS Report), and the AOEC at IR Site 24 is located in an area where these forces are not expected to mobilize cap components.
General Comment 3. The remediation goals for Site 24 were adopted from the *Final Record of Decision, Site 17, Seaplane Lagoon*, dated October 2006 (Site 17 ROD) for IR Site 17 (Seaplane Lagoon); however, a preliminary remediation goal (PRG) was not established for lead at IR Site 17. As such, a PRG for lead has not been established. According to Section 3.4 (Sediment Goals for Protection of Ecological Receptors), "The spatial distribution of sediment lead concentrations in the AOEC [area of ecological concern] at IR Site 24 is similar to that of cadmium (Figure 3-2); therefore, the preliminary RG for cadmium is expected to reduce potential ecological risk due to lead concentrations as well." This was true for the Seaplane Lagoon, but Table 2-2 indicates that there are locations where lead is present above the effects range-median (ER-M), but cadmium is below the ER-M. Also, it appears that RGs for dieldrin, chromium, copper, silver, and zinc should be developed. Please revise the FS Report to develop RGs at Site 24 for lead, chromium, copper, silver, and zinc.	**Response to General Comment 3.** Figure 3-2 confirms that the spatial distributions of cadmium and lead in sediment are similar. Therefore, the preliminary RG for cadmium is expected to successfully reduce potential ecological risk due to lead concentrations. All of the locations in the remediation area that have lead concentrations exceeding the ER-M also have cadmium concentrations exceeding the ER-M. These ER-M exceedances are consistent with the conclusion that the cadmium and lead distributions are spatially similar. In addition, a preliminary RG for lead was not developed due to the uncertainties involved as discussed in the FS Report. Preliminary RGs were developed for the COPCs identified in the ecological risk assessment that were risk drivers, which did not include dieldrin, chromium, copper, silver, or zinc. ER-M values are screening values and may be used to determine if a baseline ecological risk assessment is required. ER-Ms are not suitable as RG values and should not be used as action thresholds. Therefore, in accordance with the results of the Site 24 baseline ecological risk assessment, preliminary RG values are not necessary for dieldrin, chromium, copper, silver, and zinc. Highlights (bold, italics) within Table 2-2 have been revised for consistency with footnote f.

Comments from U.S. EPA, Xuan-Mai Tran 2/27/2008

GENERAL COMMENTS	RESPONSE TO GENERAL COMMENTS
General Comment 4. It is unclear from the text how dredged volumes were classified by existing data. Sections 6.6.1.3 (Off-Site Disposal) and B2.4 (Alternative 5 – Dredging) state that, "For FS purposes, it is assumed based on review of existing data for sediment in AOEC that 65 percent of the dredged volume would be managed as Class II nonhazardous waste, 10 percent would be classified as RCRA hazardous waste due to metal concentrations and would require stabilization to meet RCRA land-disposal restrictions, and 25 percent would be classified as California hazardous waste." It is unclear if volumes were assumed based on a distance from an existing boring location or if some other method was used. Please revise the FS Report to clarify how dredged volumes were classified for off-site disposal.	**Response to General Comment 4.** The percentages were revised to reflect more conservative cost assumptions. No TCLP or STLC testing results were reported for sediment samples in the RI, so these estimates are based on total metals concentrations only. The second sentence in Section 6.6.1.3, and the sentence at the end of the twelfth paragraph in Section B2.4 were replaced with the following: "For FS purposes, it is assumed that 50 percent of the dredged volume would be managed as Class II nonhazardous waste, 25 percent would be classified as RCRA hazardous waste due to metal concentrations and would require stabilization to meet RCRA land-disposal restrictions, and 25 percent would be classified as California hazardous waste. These percentages were based on an evaluation of the concentrations of COCs in sediment in the AOEC. These percentages are assumptions based on existing data, and were used to estimate the off-site disposal costs of the dredged sediments. Actual percentages and volumes of dredged sediments classified as nonhazardous or hazardous waste will be determined after reviewing the analytical results of waste profile samples before off-site disposal." The cost estimate assumptions and cost estimate summary tables in Appendix B have been updated to reflect the above change.
General Comment 5. Many sections of the document discuss the duration of the alternatives, and often Alternatives 2, 3 and 4 are all stated to have an expected duration of 30 years (e.g. page 7-1). In some places, it is specifically stated that the 30 years is for costing purposes, and we do not object to estimating cost based on 30 years duration for all three of these alternatives. However, simply stating that the duration of all three alternatives is 30 years is misleading. It would be helpful for the reader to know, in summary pages such as page 7-1 and the executive summary, how long ICs are actually expected to be needed (as discussed below, we think this might be in perpetuity); how long the monitored natural recovery (MNR) would be expected to take (as discussed below, this would appear to be a little over 30 years, assuming the need for a 12-inch cover as discussed regarding the capping alternative); and how long the capping would take (2.5 months, according to Section 6.5.2.5).	**Response to General Comment 5.** As stated in Section 6.3, time until RAOs are achieved would not be known for Alternative 2 (ICs) because there would be no measures to assess natural recovery processes, if they occur. However, for cost-estimating purposes, ICs are assumed to be in place for 30 years for Alternative 2. It is assumed that the sediment exposure interval for ecological receptors is 0 to 10 inches. Sufficient sediment data are not currently available to predict the duration of the MNR program; however, using an assumed sedimentation rate of 0.3 inch per year, it is conservatively estimated that 10 inches (25 cm) of fresh sediment would be deposited at the site in approximately 33 years. Therefore, for cost-estimating purposes, it is assumed that the duration of Alternative 3 (MNR with ICs) is 30 years (see Section 6.4.1.2).

GENERAL COMMENTS	RESPONSE TO GENERAL COMMENTS
General Comment 5 (continued).	**Response to General Comment 5 (continued).** The second sentence in the second paragraph of Section 6.5.1.2 was replaced with the following: "The thin-layer cap would be 10 to 12 inches thick over an assumed area of approximately 18,000 square feet. For cost-estimating purposes, a 12-inch-thick cap was assumed to account for variations in cap placement during implementation." In the second paragraph of Section 7, introductory text bullets were revised as follows: • **Alternative 1 – no action.** No further action of any type would be taken. • **Alternative 2 – ICs.** ICs are assumed to be required indefinitely. For cost-estimating purposes, ICs would be implemented for an assumed duration of 30 years. • **Alternative 3 – MNR with ICs.** The duration for the ICs is based on the results of the monitoring. For cost-estimating purposes, MNR would be performed in association with ICs for an assumed duration of 30 years. The MNR program and ICs would be put in place until the regulatory agencies and the Navy agreed that the MNR program and ICs were no longer warranted. • **Alternative 4 – thin-layer capping with ICs.** A thin-layer cap would be installed over the remediation area where concentrations of COCs in sediment exceed preliminary RGs. A monitoring program and ICs would be put in place until the regulatory agencies and the Navy agreed that monitoring and ICs were no longer warranted. For cost-estimating purposes, the assumed duration for this alternative is 30 years. • **Alternative 5 – sediment removal/dredging.** Dredging or a similar technology would be performed to remove sediment with COC concentrations exceeding preliminary RGs. No ICs or long-term O&M activities would be implemented for this alternative. The assumed duration for this alternative is 1 year.

Comments from U.S. EPA, Xuan-Mai Tran 2/27/2008

SPECIFIC COMMENTS	RESPONSE TO SPECIFIC COMMENTS
Specific Comment 1. **Executive Summary, Table ES-1, Page 1 of 1:** For compliance with ARARs, Alternative 1 should be "not applicable" rather than "yes".	**Response to Specific Comment 1.** Comment noted. This change was made in Table ES-1. In addition, the superscript "a" was inadvertently omitted after the "No" under the Overall Protectiveness criteria for Alternative 1, the no action alternative. The superscript "a" was added.
Specific Comment 2. **Section 2.2, Site Description and Operations, Page 2-2:** According to Section 2.2, "Storm drain lines leading to Outfalls K and L were replaced with polyvinyl chloride (PVC) piping in 1991. The storm drain line leading to Outfall J was cleaned and inspected in 1991 (TtEMI 1996)." It is unclear from Section 2.2 whether storm drain lines leading to Outfalls J, K and L have been cleaned and inspected since 1991. As such, it is unclear if there are still potential contaminants within the storm drain lines that could recontaminate IR Site 24. Please revise the FS Report to include additional information regarding the storm drain lines and the potential to impact IR Site 24.	**Response to Specific Comment 2.** Additional information regarding the storm drain lines leading to Outfalls J, K, and L at IR Site 24 has been added in new Section 2.2.2 to provide additional information on the storm drain system leading to Outfalls J, K, and L at IR Site 24. The following new references cited in the new section were added in Section 8 of the FS Report: Department of the Navy. 1996. Naval Air Station Alameda, Site 18 Fact Sheet, Number 8. December. Tetra Tech EM Inc. 2001. Storm Sewer Study, Technical Memorandum Addendum and Response to Agency Comments on the Draft Final Storm Sewer Study Report, Alameda Point, Alameda, California. August 30. Tetra Tech EM Inc. 2002. Data Summary Report, Supplemental RI, Data Gap Sampling for Operable Units 1 and 2. July 25.
Specific Comment 3. **Section 2.6.1, Nature and Extent of Contamination, Page 2-11:** The next to last sentence in this section states: "The range of COPEC concentrations is presented in Table 2-3;" however, Table 2-3 (Range of Concentrations of Chemicals of Potential Ecological Concern [COPECs]) presents the ranges of COPECs only in surface sediment samples. Higher concentrations were found in several deeper sediment samples, as shown in Table 2-2 (2005 and 2006 Sediment Results for Chemicals of Potential Ecological Concern). Please revise Table 2-3 to include the deeper sediment concentration ranges.	**Response to Specific Comment 3.** Table 2-3 was revised to include the deeper sediment concentration ranges as separate columns.

SPECIFIC COMMENTS	RESPONSE TO SPECIFIC COMMENTS
Specific Comment 4. **Section 2.6.1.1, Metals, Page 2-12:** It is unclear why the text states that silver is "likely naturally occurring." Silver is used in photographic chemicals, as electrical conductors, for water purification, in dental fillings, in various medical and scientific equipment, and for silver plating. Given the wide range of uses of silver and the fact that IR Site 24 received industrial discharges, it should not be concluded that silver is naturally occurring, unless it can be demonstrated that there were no industrial, dental or medical uses of silver in the area where storm sewers discharged to IR Site 24. Please delete the statement that silver is "naturally occurring."	**Response to Specific Comment 4.** The statement that silver is "naturally occurring." was deleted. The second sentence of the third paragraph in Section 2.6.1.1 was revised as follows: "In the 2005 subsurface samples collected in open-water areas at IR Site 24, metals concentrations were generally uniform with depth, and all metals concentrations were below the ER-M value except for nickel and silver; nickel concentrations throughout the open-water areas were not statistically different from background (Battelle et al. 2007)."
Specific Comment 5. **Section 2.7.1, Human Health Risk Assessment, Pages 2-14 and 2-15:** (a) This section finds no human health risk because shellfish habitat and gathering of shellfish are unlikely. However, there is no discussion of risk to humans through consumption of finfish, as there was in the neighboring Site 17 ROD. The only apparent explanation in the text of the FS Report is that access to the area for recreation is difficult due to currently-existing piers. However, unless there are ICs prohibiting removal of the piers, it cannot be assumed that they will remain in place. More explanation should be given why there is no risk to humans from fishing. (b) Section 6.2.2.1 (evaluation of the no action alternative) on page 6-6 states that there are no complete human-health exposure pathways, but "future development of the site would not be restricted under this alternative; therefore, exposure routes could develop in the future without land-use restrictions." This suggests that there could be human health risk in the future if there are no ICs restricting land use. This appears to contradict the conclusions in Section 2.7.1.	**Response to Specific Comment 5.** The FS report was revised to add more information. Also, please refer to Table 7-2 in the Final RI Report for a comparison of the modeled fish tissue concentrations for IR Site 24 to reference location concentrations. In response to this comment, a summary of risk to humans through consumption of finfish (which was evaluated in the RI Report) was added to Section 2.7.1. The last sentence of Section 2.7.1 was replaced with the following sentence: "Based on this information, no complete human-health exposure pathways were identified for shellfish at IR Site 24 (Battelle et al. 2007)." The following paragraph was added at the end of Section 2.7.1: "With respect to consumption of sport fish, individuals have been reported to have fished from the piers. The limited shallow habitat makes it unlikely that there is a significant number of resident fish species; therefore, fish targeted by anglers at the site are likely to be sport fish with relatively large foraging ranges, making it difficult to apportion site-specific risks. However, to evaluate the potential risks at IR Site 24 as part of the RI, fish tissue concentrations were modeled based on the sediment EPCs and the BAFs developed in the RI Report and compared to tissue concentrations reported at reference locations. In general,

Comments from U.S. EPA, Xuan-Mai Tran 2/27/2008

SPECIFIC COMMENTS	RESPONSE TO SPECIFIC COMMENTS
Specific Comment 5 (continued).	**Response to Specific Comment 5 (continued).** the modeled fish tissue concentrations were lower than or similar to those reported for reference locations. Therefore, the potential risks to human health due to consumption of fish were determined to be low and comparable to risk associated with reference locations and no further evaluation was recommended in the RI Report (Battelle et al. 2007)."
Specific Comment 6. **Section 3.1, Affected Media and Chemicals of Concern, Page 3-1:** The first paragraph of Section 3.1 states that, "No continuing sources of sediment contamination from land (such as flow of contaminated groundwater or ongoing discharge of contaminated sediment) have been identified at IR Site 24;" however, according to Section 2.2 (Site Description and Operations), storm drain lines leading to Outfalls J, K and L have not been cleaned and inspected since 1991. As such, it is unclear if potential contaminants exist within the storm drain lines. Please revise the FS Report to include additional information regarding the storm drain lines and the potential to impact IR Site 24.	**Response to Specific Comment 6.** Additional information regarding the storm drain lines leading to Outfalls J, K, and L at IR Site 24 has been added in new Section 2.2.2. See Response to Specific Comment 2 for additional references.
Specific Comment 7. **Section 3.1, Affected Media and Chemicals of Concern, Page 3-2 and Figure 3-1, Area of Ecological Concern with Exceedances of Preliminary Remediation Goals:** Given the uncertainties associated with the risk to ecological receptors and the finding of the highest concentration in surface sediment of dieldrin (22.35 micrograms per kilogram [ug/kg]) and six low molecular weight polynuclear aromatic hydrocarbons (LPAH6 - 25,727 ug/kg) at location PA C-22, this location should be included in the footprint of the AOEC. The concentration of LPAH6 is more than 8 times the ER-M. Please include location PA C-22 within the AOEC footprint.	**Response to Specific Comment 7.** PA C-22 has not been included in the AOEC because none of the chemicals reported at this location exceeded preliminary RGs. The dieldrin concentration (22.35 ug/kg) listed in the comment is not associated with PA C-22, but rather PA C-23, which is already included in the AOEC. The LPAH location provided in the comment is accurate; however, the ER-M is not a suitable basis for determining remedial action. ER-M values are screening values and may be used to determine if a baseline ecological risk assessment is required. The risk assessment presented in the Final RI Report did not find potential ecological risk associated with the concentrations of LPAHs. PAHs were not retained during the Tier 2 ecological risk assessment as a potential chemical of ecological concern. Therefore, in accordance with the results of the Site 24 baseline ecological risk assessment, preliminary RG values are not necessary for dieldrin and LPAHs.

RESPONSE TO COMMENTS ON DRAFT FEASIBILITY STUDY REPORT, IR SITE 24 ALAMEDA POINT, ALAMEDA, CALIFORNIA DATED NOVEMBER 2007 BEI-7526-0087-0032

Comments from U.S. EPA, Xuan-Mai Tran 2/27/2008

SPECIFIC COMMENTS	RESPONSE TO SPECIFIC COMMENTS
Specific Comment 8. **Section 3.2, RAO bullets, Page 3-4:** Based on the same concerns as stated in our question regarding Sections 2.7.1 and 6.2.2.1, should there be an RAO similar to the RAO for Site 17 to reduce potential biomagnifications of total PCBs in organisms higher in the food chain to reduce potential human health risks from the consumption of fish.	**Response to Specific Comment 8.** The small area of elevated concentrations under the wharf road is very different from IR Site 17. The limited shallow habitat makes it unlikely that there is a significant number of resident fish species; therefore, fish targeted by anglers at the site are likely to be sport fish with relatively large foraging ranges, making it difficult to apportion site-specific risks. As noted in the Response to Specific Comment 5, the potential risks to human health due to consumption of fish were determined to be low and comparable to risk associated with reference locations and no further evaluation was recommended in the RI Report (Battelle et al. 2007). Text has been added to Section 2.7.1 summarizing the results of the human health risk assessment presented in the RI Report. Please see the Response to Specific Comment 5 for additional details.
Specific Comment 9. **Section 4.3.2, Institutional Controls, Page 4-3:** (a) The potential ICs include restrictions on dredging; however, page 2-2 states that in the past, the area was dredged periodically. Also, Section 7.1 (p. 7-2) states that future site use would consist of docking large-scale ships such as ferries, cruise ships, or historical landmark vessels. The FS Report should discuss whether restrictions on dredging are compatible with the probable future reuse of the site. (b) The potential ICs do not include restrictions on high-energy forces such as boat wakes, propeller scour, keel drag, or large-boat anchoring. While the document at page 4-8 states that the area is protected from these forces, this is not explained, although it could be inferred from elsewhere in the document that this is because of the pilings for the wharf road. We recommend that the Navy consider including ICs of this type or explain why they are not necessary.	**Response to Specific Comment 9.** (a) It is unlikely that large-scale ships would dock at the AOEC at IR Site 24 that is the subject of the FS because the water depth is shallow on the sediment shelf adjacent to and beneath the wharf road. Instead, these ships would use the existing Piers 1, 2, and 3, where large-scale ships are routinely docked. However, to account for the possibility in the future that dredging at AOEC may be performed, the first bullet in Section 4.3.2 was modified as follows: • "prohibit disturbance to and resuspension of impacted sediment by restricting future dredging and construction activities in the AOEC without approval from the Navy and regulatory agencies;" ICs restricting future dredging and construction activities without approval from the Navy and regulatory agencies would ensure that effective best management practices (e.g., using silt screens/curtains to contain particulate suspension during dredging and construction activities; turbidity monitoring; proper handling, storage, and disposal of contaminated sediments) are performed. Actual ICs to be implemented at IR Site 24 would be established in the ROD and subsequent remedial design/remedial action documentation.

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Specific Comment 9 (continued).	**Response to Specific Comment 9 (continued).** (b) Because the AOEC at IR Site 24 is primarily underneath the wharf road, the support pilings of the road and the cross members along the quay wall do not allow access to most of the AOEC. Inside the breakwater, boat wakes would be minimal, because larger ships that might otherwise generate significant wake cannot attain high enough speeds to generate a large wake in such a small area. If a vessel were to access the area, propeller scour would only act to push sediment into the AOEC, not the open water. Restrictions on boat anchoring are not necessary because vessels are moored at the piers, and typically would not drop anchor at the piers.
Specific Comment 10. **Section 4.3.4, Monitored Natural Recovery, Page 4-7:** Could the monitoring itself induce disturbances in the sediment that could affect the effectiveness of MNR?	**Response to Specific Comment 10.** Monitoring activities, such as sediment sampling to measure deposition rates and changes in contaminant concentrations, are expected to minimally disturb the sediment at the AEOC at IR Site 24. These activities are not expected to cause any more disturbance than normal tidal action, and would not reduce the effectiveness of the MNR program.
Specific Comment 11. **Section 5.1.2, Alternative 2 – ICs, Page 5-3:** What is the rationale for prohibiting removal of the wharf road as a way of preventing contaminated sediment from being disbursed into the open water?	**Response to Specific Comment 11.** The description of ICs for IR Site 24 has been revised as described in the Response to Specific Comment 9 to clarify the objective of preventing disturbance of sediment on the AOEC. Because the AOEC at IR Site 24 is primarily underneath the wharf road, the support pilings of the road and the limited access caused by these pilings and cross members protect the area from high-energy forces that could disturb impacted sediment. Significant mobilization of contaminated sediment into the open-water area of IR Site 24 is not expected to occur in natural conditions. Removal of the wharf road and support pilings would disturb the sediment. If the wharf road and support pilings are to be removed, the ICs included in the remedial alternatives would require approval from regulatory agencies and the Navy to ensure that effective best management practices (e.g., using silt

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Specific Comment 11 (continued).	**Response to Specific Comment 11 (continued).** screens/curtains to contain particulate suspension during dredging and construction activities; turbidity monitoring; proper handling, storage, and disposal of contaminated sediments) are implemented to prevent contaminated sediment from being disbursed into the open-water area of IR Site 24.
Specific Comment 12. **Section 5.1.5, Alternative 5 - Dredging, Page 5-5; Section 5.1.6, Alternative 6 – In Situ Grouting, Page 5-6; Section 6.6.1.5, Reviews and Reporting, Page 6-20; and Appendix B, Cost Development Summaries:** The text states that a five-year review is assumed not to be required because the remedies are expected to be complete in one year, but a five-year review is still required to record that a remedy has been completed and that it is protective, since contaminants will remain in place in the remainder of Site 24. Please revise the text and cost estimate to include a five-year review for each of these alternatives.	**Response to Specific Comment 12.** A 5-year review pursuant to CERCLA Section 121 and the NCP is required only if the selected remedy allows contaminants to remain at the site above levels that would allow for unrestricted use of the site. Alternative 5 would employ dredging or a similar technology to remove sediment with COC concentrations exceeding the preliminary RGs, thereby allowing unrestricted use of the site. A remedial action closeout report would be prepared as part of Alternative 5 to record that the selected remedy has been completed and contaminants successfully removed. Because the assumed total duration of this alternative is less than 5 years, a 5-year review is not included. Five-year reviews were added to Alternative 6 in Section 5.1.6, as described in the Response to Specific Comment 13.
Specific Comment 13. **Section 5.1.6, Alternative 6 – In Situ Grouting, Page 5-6:** The text states that no long-term monitoring is required for Alternative 6. However, in situ grouting is an emerging technology in the early stages of development. As such, it is unclear why long-term monitoring along with bench-scale and pilot-scale treatability testing has not been proposed for Alternative 6 to evaluate the effectiveness of in situ grouting. Please revise Alternative 6 to include long-term monitoring to evaluate the effectiveness of in situ grouting.	**Response to Specific Comment 13.** Monitoring and ICs (see Response to Specific Comment 40) were added as part of Alternative 6. The title of this alternative was changed to "In Situ Grouting With ICs" throughout the FS report and tables. The following sentence was added as the second sentence in the first paragraph in Section 5.1.6: "In addition to *in situ* grouting, Alternative 6 would include ICs." The third and fourth paragraphs of Section 5.1.6 were combined and revised as follows: "Confirmation sampling would be performed at the end of the grouting activities in order to verify that the contaminated sediment has been properly solidified/stabilized. A monitoring program, including 5-year reviews, would be

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Specific Comment 13 (continued).	**Response to Specific Comment 13 (continued).** implemented to ensure the integrity of the solidified/stabilized treatment area. Once monitoring results indicated that ICs were no longer warranted, the ICs would be discontinued. The ICs would be similar to those described for Alternative 3." The last sentence for Alternative 6 under the Effectiveness column in Table 5-2 was modified as follows: "A monitoring program and ICs would be implemented to ensure the integrity of the solidified/stabilized treatment area." The following sentence was added as the last sentence for Alternative 6 under the Cost column in Table 5-2: "Cost of ICs could be high, depending on duration."
Specific Comment 14. **Section 5.2, Screening of Remedial Alternatives, Page 5-6:** This section states that Alternative 6, in-situ grouting, is eliminated from further consideration, in part because it would be expected to have a significant negative impact to the benthic community. Elsewhere the document indicates that both the thin-layer cap and dredging would destroy existing habitat. Why this is apparently considered to be a larger problem with Alternative 6 than with the other alternatives?	**Response to Specific Comment 14.** Unlike Alternatives 4 and 5, Alternative 6 would permanently destroy benthic habitat in the AOEC. However, the primary reasons for screening out this alternative are those presented in the first sentence in the third paragraph of Section 5.2 (uncertain effectiveness, in the early stages of development, and few delivery methods are currently commercially available). For clarification, the second sentence of the last paragraph in Section 5.2 referring to the benthic community was deleted. Similarly, the last sentence for Alternative 6 under the Conclusion column in Table 5-2 was also deleted.
Specific Comment 15. **Section 5.2, Screening of Remedial Alternatives, Page 5-6:** Since ICs alone will not address the ecological concerns at this site, how can Alternative 2, ICs alone, be a viable alternative? As discussed elsewhere, we also question whether this alternative meets the threshold protectiveness criterion. We note that ICs alone were not included as one of the alternatives for Site 17, Seaplane Lagoon. Additionally, the discussion of general response actions on page 4-1 states that ICs reduce potential human hazards, but does not mention ecological risks.	**Response to Specific Comment 15.** The presentation and evaluation of Alternative 2 were revised so that natural recovery is not considered part of the process as described in the Response to General Comment 1. While natural recovery processes may occur, without a means to monitor the processes, they should not be relied upon. ICs are an effective means of managing sediment disturbance at the AOEC at IR Site 24. If subsurface sediment with elevated concentrations of COCs is distributed throughout a larger portion of IR Site 24, potential ecological exposure would be expected to increase. Since the risk estimates presented in

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Specific Comment 15 (continued).	**Response to Specific Comment 15 (continued).** the RI Report indicated that the potential ecological risk was not great (HQs not greatly exceeding 1), ICs would be effective at prohibiting subsurface sediment from causing greater risk. The ICs bullet in Section 4-1 was revised, deleting the word "public." ICs reduce potential hazards by limiting exposure as noted above.
Specific Comment 16. **Section 6.3.2.1, Overall Protection of Human Health and the Environment, Page 6-7:** This section states that Alternative 2, ICs, is considered protective of human health and the environment. It appears that this conclusion is based on the assumption that natural recovery would reduce ecological exposure. However, with this not being monitored, it cannot be assumed that this will happen, as suggested by the discussion regarding the no action alternative (Section 6.2.2.1). EPA questions whether Alternative 2 – ICs alone -- meets this threshold criterion.	**Response to Specific Comment 16.** As discussed in the Responses to General Comment 1 and Specific Comment 15, Alternative 2 was revised to remove discussions about the natural recovery processes. The ICs are expected to limit exposure of ecological receptors to subsurface sediment concentrations that could increase ecological risk.
Specific Comment 17. **Section 6.3.2.3, Long-Term Effectiveness and Permanence, Page 6-8 and Section 6.4.2.3, Long-Term Effectiveness and Permanence, Page 6-11:** The actual sedimentation rate at IR Site 24 is unknown. For the purposes of the FS Report, the sedimentation rate at Site 24 is assumed to be at least one-half of the sedimentation rate estimated for the Seaplane Lagoon, but it is unclear from the text whether Site 24 features (e.g., piers, quay road, foundations and pilings) as well as the presence or absence of sediment sources from onshore run-off have been incorporated into the assumed sedimentation rate. Please revise the descriptions of Alternatives 2 and 3 to include an evaluation of the sedimentation rate at Site 24.	**Response to Specific Comment 17.** Ongoing natural recovery processes (i.e., sedimentation) would be expected to continue to isolate impacted sediment and reduce ecological exposure to COCs in sediment over time. These natural recovery processes would not be monitored for Alternative 2. The last sentence of the first paragraph in Section 6.4.2.3, Long-Term Effectiveness and Permanence for Alternative 3, was revised as follows: "Sediment sampling and analysis, bathymetric surveys, and periodic reviews would be performed to evaluate the sedimentation rate, lines of evidence, and progress of MNR to continue reducing ecological risk."

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Specific Comment 18. **Section 6.3.2.4, Reduction of Toxicity, Mobility, or Volume Through Treatment, Page 6-8:** The text states that the "toxicity, mobility, or volume of COCs [contaminants of concern] in sediment would be reduced through time through passive natural processes," but this cannot be assumed for Alternative 2 (ICs) because there is no monitoring to verify that this would occur. Further, monitored passive natural processes are part of Alternative 3, so Alternative 2 should be less effective than Alternative 3. Please delete the quoted statement or revise the text to clarify that since reduction of toxicity, mobility, or volume cannot be verified, it cannot be assumed to occur.	**Response to Specific Comment 18.** The second sentence in Section 6.3.2.4 has been deleted as described in the Response to General Comment 1. Alternatives 2 and 3 are both ranked low in Reduction of Toxicity, Mobility, or Volume Through Treatment, because these alternatives do not have an active treatment component.
Specific Comment 19. **Section 6.4.1.1, Predesign Investigation, Page 6-9:** It is unclear how collection of one homogenized sediment sample from each location can be used to estimate the sedimentation rate. Please provide information to clarify how the sedimentation rate will be determined.	**Response to Specific Comment 19.** The sedimentation rate will be determined from chemical and bathymetric survey data at the AOEC. The fourth bullet in Section 6.4.1.1 was revised and separated into two bullets as follows: • Collect and analyze one homogenized sediment sample across the exposure interval at each of the 18 permanent locations to assess the extent of COCs in sediment. • Collect and analyze a core sediment sample from each of nine locations across the sediment interval and calculate the sedimentation rate from chemical and bathymetric survey data at the AOEC.
Specific Comment 20. **Section 6.4.1.2, Sediment Monitoring Program, Page 6-9:** This paragraph states that sufficient sediment data are not currently available to predict the duration of the MNR program. When will such data be available? Are there adequate data to predict whether MNR would be a viable alternative?	**Response to Specific Comment 20.** The sediment monitoring program is assumed to include bathymetric surveys as well as sediment sampling and analysis every 5 years for the duration of the alternative. After the first sediment sampling and bathymetric survey for the baseline and in year 5, more data on the sedimentation rate would be available. The MNR program would be reviewed and optimized based on the survey and analytical results. The final monitoring program would be developed in the remedial design stage. Sufficient data are available to evaluate MNR for FS purposes, but additional data would be necessary to predict the duration of Alternative 3.

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Specific Comment 21. **Section 6.4.1.2, Sediment Monitoring Program, Page 6-10:** The first full paragraph on page 6-10 states that approximately 10 inches of fresh sediment would be deposited at the site in a 30-year period, so 30 years is used as the duration of this alternative for cost-estimating purposes. However, there is no discussion of whether this is anticipated to meet the RAOs, or whether the other parts of the MNR remedy would be expected to be achieved within that time. There is also some confusion because Page 6-14 states that a 12-inch cap is considered sufficient. While the difference between 10 and 12 inches may not translate into many years (about 7, at the rate of 0.3 inches per year mentioned on page 6-10), the inconsistency is somewhat confusing. EPA's preference would be for the document to state that the actual time for MNR would be the time it takes to achieve a 12-inch cover, although 30 years could still be used for cost estimating.	**Response to Specific Comment 21.** The duration for the ICs is based on the results of the monitoring. For cost-estimating purposes, MNR would be performed in association with ICs for an assumed duration of 30 years. The MNR program and ICs would be put in place until the regulatory agencies and the Navy agreed that the MNR program and ICs were no longer warranted. Please refer to the Response to General Comment 5 for additional information.
Specific Comment 22. **Section 6.4.1.2, Sediment Monitoring Program, Page 6-10:** The last paragraph of the section states that, "The MNR program would include periodic bathymetric surveys and sediment sampling and analysis." However, details regarding the sediment sampling and the analysis program have not been included in the text. Please revise the text to include details (i.e., sampling depth, number of sampling locations and analysis parameters) regarding the sediment sampling analysis program or reference the information provided in Table B-1 (Cost Estimate Assumptions for IR Site 24 Remedial Alternatives).	**Response to Specific Comment 22.** Details regarding the sediment sampling and analysis program have been included in Appendix B, Section B2.2 and Table B-1. The final sediment monitoring program would be developed in the remedial design stage. Section 6.4.1.2 was not modified to reflect the above mentioned clarifications.
Specific Comment 23. **Section 6.4.2.1, Overall Protection of Human Health and the Environment, Page 6-11:** This section indicates that ICs would be implemented during remediation. Wouldn't the ICs also need to remain in place after the MNR period has been completed in order to ensure that the natural cover is not being eroded or significantly compromised by external forces (as discussed with regard to the constructed cap in Section 6.5.1.4)?	**Response to Specific Comment 23.** The following sentence has been added after the third sentence in Section 6.4.2.1: "ICs would remain in place until RAOs were achieved or the Navy and regulatory agencies agreed that the site no longer posed potentially unacceptable ecological risk."

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Specific Comment 24. **Section 6.4.2.3, Long-Term Effectiveness and Permanence, Page 6-11:** (a) This states that it is assumed that the sediment exposure interval for ecological receptors is 10 inches. Since the discussion of the thin-layer capping assumes a 12-inch cap (Section 6.5, page 6-12), shouldn't MNR goal also be a 12-inch natural cover? (b) The last paragraph on page 6-11 states that Alternative 3 assumes that ICs would be implemented for 30 years. Is that just for costing purposes, or is it actually expected that no ICs will be needed after 30 years. If the latter, does that mean that no ICs would be necessary to protect the expected 10-inch natural cover? (c) Doesn't there need to be monitoring in perpetuity to make sure the natural cover is not being eroded or significantly compromised by external forces, as is contemplated for the constructed cap alternative (Section 6.5.1.4)?	**Response to Specific Comment 24.** (a) See Response to General Comment 5. The goal for Alternative 3 (MNR with ICs) would be a 10-inch natural cover because the sediment exposure interval for ecological receptors is 0 to 10 inches. (b) The Navy has not suggested that ICs and monitoring of those ICs would necessarily end in 30 years, but rather that costs developed for the purposes of this FS Report assume a duration of 30 years. This is consistent with U.S. EPA's *Guidance for Development of Remedial Investigations and Feasibility Studies under CERCLA,* which suggests that a 30-year time horizon is appropriate. The last paragraph in Section 6.4.2.3 was revised as follows: "For cost-estimating purposes, it is assumed that ICs under Alternative 3 would be implemented for 30 years. However, once sediment monitoring results indicated that the preliminary RGs had been reached or that ICs were no longer warranted, the regulatory agencies and the Navy would determine whether the ICs and monitoring program could be discontinued for Alternative 3." (c) See response to part (b) above.
Specific Comment 25. **Section 6.4.2.5, Short-term Effectiveness, Page 6-12:** The short-term effectiveness of Alternative 3 is unclear from this section. The text states, "Implementation of the components of Alternative 3 would not be expected to have adverse effects on site workers, the surrounding community, or the environment. ICs could be put in place in a short period of time to prohibit disturbance of sediment in the AOEC." This does not address short-term effectiveness. Please revise Section 6.4.2.5 to clarify the short-term effectiveness of Alternative 3. Also, the duration of the remedy is considered a component of short-term effectiveness and should be mentioned here.	**Response to Specific Comment 25.** Parameters considered in the short-term effectiveness evaluation are: • short-term risks to community • impacts on workers • environmental impacts • time until protection is achieved The following statement was added at the end of Section 6.4.2.5 and in Table 6-1 under the Short-Term Effectiveness column for Alternative 3: "Time until protection is achieved for Alternative 3 is assumed to be approximately 30 years, based on a sedimentation rate of 0.3 inch per year. For cost-estimating purposes, the duration of the MNR program and ICs under Alternative 3 is assumed to be 30 years. The estimated sedimentation rate and

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Specific Comment 25 (continued).	**Response to Specific Comment 25 (continued).** the resulting time until protection is achieved would be reassessed as part of the 5-year review process based on evaluation of monitoring data collected during the MNR period. ICs would remain in place until RAOs were achieved or the Navy and regulatory agencies agreed that the site no longer posed potentially unacceptable ecological risk."
Specific Comment 26. **Section 6.5, Alternative 4 - Thin-Layer Capping With ICs, Page 6-12:** The description of this alternative does not discuss whether the existing sediment would support the sand used for a thin-layer cap (i.e., that the sand would not fall through fine-grained sediment) or provide justification for the assumption that the biologically active zone is only four to six inches. Some worms burrow to depths of 24 to 36 inches. Please clarify whether the existing sediment is sufficiently solid to support a thin layer cap and to justify the assumption about the thickness of the biologically active zone.	**Response to Specific Comment 26.** The ability of sediment to support the sand cap is a design parameter that would be evaluated in the remedial design stage. During 2006 sampling as part of the RI, field notes and photographs from cores advanced in the AOEC appeared to indicate that the sediment would support the sand layer. Alternative 4 includes a predesign investigation to collect design information for use in cap design as discussed in Section 6.5.1. Some benthic organisms burrow to depths of 24 to 36 inches. These organisms are not expected to occur in the AOEC since it is largely beneath the wharf road. Even in areas where organisms burrow to such depths, the biological active zone is intended to represent the depth of sediment in which most biological activity occurs. It is not intended to represent the depth of sediment used by every individual organism.
Specific Comment 27. **Section 6.5, Alternative 4, Thin-Layer Capping with ICs, Page 6-12:** As with the MNR alternative, the document should discuss whether ICs, and monitoring of those ICs, would be necessary after the cap is installed in order to protect it.	**Response to Specific Comment 27.** The Navy has not suggested that ICs and monitoring of those ICs for Alternative 4 would necessarily end in 30 years, but rather that costs developed for the purposes of this FS Report assume a duration of 30 years. The last two sentences of Section 6.5 were revised as follows: "For cost-estimating purposes, the assumed duration of Alternative 4 would be 30 years. However, once sediment monitoring results indicated that the preliminary RGs had been reached or that ICs were no longer warranted, the regulatory agencies and the Navy would determine whether the ICs could be discontinued." Please also see Response to General Comment 5.

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Specific Comment 28. **Section 6.5.1, Description of Alternative, Page 6-13:** The first bullet states that propeller scour is not expected to be a concern because the AOEC is primarily under the wharf road and sediment disturbance by boat propellers is not expected to cause significant mobilization of contaminated sediment into the open water. This suggests that the IC prohibiting removal of the road would be needed in perpetuity. There should be more explanation of how the road protects. Is it actually the pilings underneath the road that are considered protective? If the pilings supporting the road need repair, would there be a potential for disturbance to either a cap installed under Alternative 4 or the natural cover anticipated by Alternative 3?	**Response to Specific Comment 28.** See Responses to Specific Comments 9 (b), 11 and 27 regarding the objectives and duration of ICs. The rationale for ICs is clarified in the Response to Specific Comment 15. Removal of the pilings under the road would disturb the sediment. If uncontrolled, disturbed sediment could disperse into the open water. Therefore, the ICs prohibit removal of the wharf road structure and/or its pilings (without approval from the Navy and regulatory agencies).
Specific Comment 29. **Section 6.5.1.4, Monitoring, Page 6-14:** Alternative 4 includes both construction and performance monitoring, but it is unclear what measures have been put in place to ensure the construction and performance monitoring does not damage the thin-layer cap. Please revise the FS Report to specify necessary measures to ensure construction and performance monitoring would not damage the thin-layer cap.	**Response to Specific Comment 29.** The construction and performance monitoring program elements would be developed in the remedial design phase. Monitoring activities, such as bathymetric surveys and subsurface sediment sampling to measure deposition rates and changes in contaminant concentrations, are expected to minimally disturb the sediment at the AEOC at IR Site 24. These activities would not significantly reduce the effectiveness of the monitoring program.
Specific Comment 30. **Section 6.5.1.4, Monitoring, Page 6-14:** Wouldn't the performance-monitoring have to be done in perpetuity?	**Response to Specific Comment 30.** A monitoring program (and ICs) would be put in place until the regulatory agencies and the Navy agreed that monitoring and ICs were no longer warranted. The last two sentences of Section 6.5 were revised as follows: "For cost-estimating purposes, the assumed duration of Alternative 4 would be 30 years. However, once sediment monitoring results indicated that the preliminary RGs had been reached or that ICs were no longer warranted, the regulatory agencies and the Navy would determine whether the ICs could be discontinued." Please also refer to the responses to General Comment 5 and Specific Comment 27.

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Specific Comment 31. **Section 6.5.2.1, Overall Protection of Human Health and the Environment, and Section 6.5.2.3, Long-Term Effectiveness and Permanence, Page 6-15:** Is the assumed duration of ICs 30 years for costing purposes, or in perpetuity? Wouldn't they have to be in effect in perpetuity in order to protect the cap?	**Response to Specific Comment 31.** The assumed 30-year duration of Alternative 4 is for costing purposes. ICs would remain in place until RAOs were achieved or the Navy and regulatory agencies agreed that the site no longer posed potentially unacceptable ecological risk. Please also see Responses to General Comment 5 and Specific Comment 27.
Specific Comment 32. **Section 6.6.1.1, Predesign Investigation, Page 6-18:** Section 6.6.1.1 does not discuss the inclusion of information on construction and stability of Site 24 structures (i.e., wharf road, quay wall, piers, foundations and pilings) in and near the proposed dredging area. Please revise Section 6.6.1.1 to include an evaluation of the stability of Site 24 structures in and near the proposed dredging area to aid in preparing detailed design documents. Also, it is unclear whether predesign sampling would also evaluate the horizontal extent of contamination. Please clarify whether predesign sampling will also evaluate the horizontal extent of contamination or explain why this is not necessary.	**Response to Specific Comment 32.** Some of the preliminary costs (review of documents) related to information on construction and stability of IR Site 24 structures (i.e., wharf road, quay wall, piers, foundations and pilings) in and near the proposed dredging area are assumed to be included in the remedial design (Table B-1). The last paragraph in Section 6.6.1.2 describes evaluation of the wharf road, quay wall, piers, foundations and pilings in the detailed design. Details regarding the FS assumptions for the sediment sampling and analysis program related to the horizontal extent of contamination have been included in Appendix B, Section B2.2 and Table B-1. However, it should be noted that the final sediment monitoring program would be developed in the remedial design stage.
Specific Comment 33. **Section 7, Comparative Analysis of Remedial Alternatives, Page 7-1:** As discussed in the general comment, it is misleading to simply state in the bullets that Alternatives 2, 3 and 4 all have an assumed duration of 30 years.	**Response to Specific Comment 33.** The text has been revised, as specified in several responses. Please refer to the Response to General Comment 5 for details.
Specific Comment 34. **Section 7.1, Overall Protection of Human Health and the Environment, Page 7-2:** Since the only difference between Alternatives 1 and 2 are ICs, it is unclear why it has been assumed that Alternative 2 will meet the threshold criterion of protection of human health and the environment. ICs are not effective for ecological receptors and there is no mitigation, treatment or monitoring in Alternative 2. Please revise the text to state that Alternatives 1 and 2 will not be protective of ecological receptors or explain how administrative and legal controls would protect these receptors.	**Response to Specific Comment 34.** Alternative 2 represents the least active of the active alternatives, and is designed to prohibit activities that could disperse impacted sediment from the AOEC into open water, potentially increasing ecological risk. Please refer to the Response to General Comment 1 for additional details.

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Specific Comment 35. **Section 7.1, Overall Protection of Human Health and the Environment, Page 7-2:** As discussed above, we question how ICs alone, without any action to address the unacceptable risk to ecological receptors, meets the threshold criterion of overall protection of human health and the environment. This comment also applies to Section 7.10 on page 7-4 (Conclusions).	Alternative 2 represents the least active of the active alternatives, and is designed to prohibit activities that could disperse impacted sediment from the AOEC into open water, potentially increasing ecological risk. Please refer to the Response to General Comment 1 for additional details.
Specific Comment 36. **Section 7.1, Overall Protection of Human Health and the Environment, Page 7-2:** The document should state that this criterion does not apply to Alternative 1, rather than stating that Alternative 1 meets this criterion.	**Response to Specific Comment 36.** It is appropriate to assess whether the No Action alternative meets the threshold criterion of Overall Protection of Human Health and the Environment. Alternative 1 was judged not to meet this threshold criterion, as described in Section 7.1, and thus was not evaluated against the primary balancing criteria. Section 7-1 was not modified to reflect any changes related to this comment.
Specific Comment 37. **Section 7.5, Short-term effectiveness, Page 7-3:** We question the appropriateness of rating Alternatives 5, 2 and 3 the same. In terms of Alternatives 5 and 3, we recognize that this is a difficult criterion to "rate," because its components are somewhat contradictory: In nearly every case, more active remedies achieve protection sooner than remedies such as MNA, but there are more potential impacts to the community. That said, given the alternatives being compared here, we think it is significant that Alternative 5 will achieve protectiveness so much sooner than Alternative 3. We would recommend giving Alternative 5 a rating more like that of Alternative 4. An alternative to changing the ratings would be to discuss Alternative 5 in a separate paragraph rather than discussing it in with the quite different Alternatives 2 and 3. We also question why Alternative 2 receives anything other than a low rating here, since "short-term effectiveness" implies that the remedy is effective, and Alternative 2 would do nothing to address the existing ecological risks.	**Response to Specific Comment 37.** Section 7.5 has been revised. The rating of Alternative 2 in the short-term effectiveness criterion has been reduced to low. This section was also revised to include discussions for the alternatives related to environmental impacts (i.e., benthic habitat destruction). The following text was added to the first paragraph in Section 7.5: "For Alternative 4, the benthic habitat in the AOEC would be covered with sand when the cap is placed. However, it would be expected to be reestablished in the granular cap material fairly quickly." The second paragraph in Section 7.5 has been revised and divided into three paragraphs to read as follows: "Alternatives 3 and 5 are rated medium in short-term effectiveness. Time until protection is achieved under Alternative 3 is expected to be longer than Alternative 5, but Alternative 3 would pose no short-term risks to the community and would have minimal impact to the benthic habitat.

SPECIFIC COMMENTS	RESPONSE TO SPECIFIC COMMENTS
Specific Comment 37 (continued).	**Response to Specific Comment 37 (continued).** "Under Alternative 5, removal of impacted sediment is expected to take up to 6 months for completion following approval of remedial design documents, so time until protection is achieved would be short. Alternative 5 would involve more short-term impacts during implementation than Alternatives 3 and 4, because it would involve dredging (or a similar technology) and transporting impacted sediment through the community en route to the approved disposal facility. The benthic community in the AOEC would be removed by this alternative, but would be expected to be reestablished in the clean backfill sand fairly quickly. "Alternative 2 is rated low for short-term effectiveness. Because this alternative does not include monitoring, the time until protection is achieved would not be known."
Specific Comment 38. **Table 5-2, discussion of effectiveness of ICs:** Should "Seaplane Lagoon" be changed to "Site 24"?	**Response to Specific Comment 38.** The change was made in response to this comment.
Specific Comment 39. **Table 5-2, discussion of effectiveness of Alternative 4:** In last sentence, "confirm" should be "ensure."	**Response to Specific Comment 39.** The change was made in response to this comment.
Specific Comment 40. **Table 5-2, alternative 6, effectiveness:** It would be helpful to briefly explain why ICs would not be necessary.	**Response to Specific Comment 40.** Alternative 6 was revised to include ICs as described in the Response to Specific Comment 13.
Specific Comment 41. **Table 5-2, cost column:** Wouldn't the cost for MNR, as with ICs and capping with ICs, depend on duration of the ICs (as well as time to reach RAOs)? With all three alternatives involving ICs, wouldn't ICs and monitoring of ICs, be necessary in perpetuity?	**Response to Specific Comment 41.** Revisions were made to clarify this. Please refer to the Response to General Comment 5.

Comments from U.S. EPA, Xuan-Mai Tran 2/27/2008

SPECIFIC COMMENTS	RESPONSE TO SPECIFIC COMMENTS
Specific Comment 42. **Table 6-3, Cost Estimate Summary for Alternative 3: MNR with ICs:** The long-term monitoring (every 5 years for 30 years) operating and maintenance cost listed in Table 6-3 is $94,800; however, it is unclear what this cost includes. Please revise the Cost Estimate Summary and Cost Estimate Assumption tables in Appendix B to include a detailed breakdown of costs.	**Response to Specific Comment 42.** Cost estimate tables for each alternative in Appendix B have been revised to include a detailed breakdown of costs.
Specific Comment 43. **Section A4.2, Alternative 2 - ICs, Page A4-3:** Please change the next-to-last sentence in this section to the following: "U.S. EPA specifically considers sections (a)(1), (a)(2), (d), (e)(1) and (e)(2) of Cal. Code Regs., tit. 22 § 67391.1, to be relevant and appropriate."	**Response to Specific Comment 43.** The EPA position was updated as suggested.
Specific Comment 44. **Table A2-2, Page 2:** The Navy concludes that the SIP is not an ARAR. However, it should be considered an ARAR for discharges to surface water from dewatering, as was done for Site 17. Effluent limitations from CWA 301(b) were included as ARARs in the Site 17 ROD based on the finding that substantive provisions were potentially relevant and appropriate for the discharge of dewatering effluent. These requirements should be included here as well. The document should discuss whether the air quality requirements identified as ARARs in the Site 17 ROD should be considered ARARs for Site 24 as well. The document should discuss whether stormwater requirements identified as ARARs in the Site 17 ROD should be considered ARARs for Site 24 as well.	**Response to Specific Comment 44.** The SIP was identified as an ARAR for discharges from dewatering at IR Site 17 because the dewatering was to be conducted over land, the effluent was to be collected, treated if necessary, and then discharged via point source back into Seaplane Lagoon. This is not the case for IR Site 24 where dredged material would be dewatered over the water where it was removed. The same rationale applies to CWA 301(b), which also applies to point sources. No point source discharges of dewatering effluent are proposed at IR Site 24. The air quality requirements for dust emissions from the IR Site 17 ROD were added for the unlikely dust emissions from handling the sediment after dredging from the bay. The IR Site 24 work is not expected to disturb an acre or more of soil during the remedial action and, therefore, the construction stormwater requirements are not potential ARARs. The construction stormwater requirements included for IR Site 17 were added to Table A4-1 (Potential Federal Action-Specific ARARs) with a determination that they are not potential ARARs for this remedial action.

Comments from U.S. EPA, Xuan-Mai Tran 2/27/2008

SPECIFIC COMMENTS	RESPONSE TO SPECIFIC COMMENTS
Specific Comment 45. **Section B2.3, Alternative 4 - Thin-Layer Capping with ICs, Page B-7:** Cap construction and performance assumptions for Alternative 4 have been provided in Section B2.3; however, it does not appear that access issues have been addressed as an assumption. Please revise Section B2.3 to include an assumption that equipment is capable of accessing the area beneath the wharf road as an assumption.	**Response to Specific Comment 45.** The following bullet was added to the first set of bullets in Appendix B, Section B2.3 and Table B-1: • Thin-layer capping is assumed to be performed using hydraulic means (using hoses) or other equipment capable of accessing the AOEC beneath the wharf road.
Specific Comment 46. **Section B2.3, Alternative 4 - Thin-Layer Capping with ICs, Page B-8 and Section B2.4, Alternative 5 - Dredging, Page B-10:** Alternative 4 includes surface-water monitoring for turbidity to ensure that capping operations do not disperse suspended sediment from the AOEC into the open-water area. However, costs associated with surface-water monitoring have not been included on the Cost Estimate Summary or Cost Estimate Assumptions tables. Surface-water monitoring should also be included in Alternative 5. Further, it is unclear whether the costs for the silt curtain have been included for either of these alternatives. Please revise the Cost Estimate Summary and Cost Estimate Assumption tables to include costs associated with surface-water monitoring. In addition, please revise the Cost Estimate Summary tables associated with Alternative 5 (Dredging) to include surface-water monitoring. Please also verify that costs have been included for a silt curtain for each of these alternatives.	**Response to Specific Comment 46.** Costs associated with surface-water monitoring and silt curtain have been included for both Alternatives 4 and 5. Tables 6-4, 6-5, B-4, and B-5 include a line item with costs for "Open-water monitoring during construction." Costs for a silt curtain have been included in Alternatives 4 and 5, as described in Appendix B (seventh paragraph of Section B2.3 and sixth paragraph of Section B2.5). No changes have been made related to this comment.

MINOR COMMENT	RESPONSE TO MINOR COMMENT
Minor Comment 1. Measurements have been provided in both metric and U.S. units throughout the FS Report text; however, only metric units have been provided on FS Report figures. Please revise the FS Report figures to present measurements in both metric and U.S. units to remain consistent with the FS Report text.	**Response to Minor Comment 1.** Except for Figure 3-2, all figures showing sediment sampling intervals (in cm as reported in the Final RI Report) already have a conversion factor from cm to ft in the Notes section. This conversion factor was added in the Notes section of Figure 3-2.

RESPONSE TO COMMENTS FROM DTSC-HERD ON DRAFT FS REPORT

RESPONSE TO COMMENTS ON DRAFT FEASIBILITY STUDY REPORT, IR SITE 24 ALAMEDA POINT, ALAMEDA, CALIFORNIA DATED NOVEMBER 2007 BEI-7526-0087-0032

Comments from DTSC-HERD, J. Polisini 2/20/2008

GENERAL COMMENTS	RESPONSE TO GENERAL COMMENTS
General Comment 1. The Feasibility Study (FS) Report does not consider potential human health impacts due to minimal direct or indirect exposure pathway but focuses on potential ecological hazard. HERD agrees with the focus on potential ecological hazard. This FS Report references and utilizes ecological Remedial Goals (RGs) developed for the nearby Seaplane Lagoon (SPL). The limitations and implementation requirements HERD placed on the SPL (IR Site 17) RGs, which are not referenced, should be included in the IR Site 24 FS Report.	**Response to General Comment 1.** Comment noted. See Response to Specific Comment 2.

RESPONSE TO COMMENTS ON
DRAFT FEASIBILITY STUDY REPORT, IR SITE 24
ALAMEDA POINT, ALAMEDA, CALIFORNIA
DATED NOVEMBER 2007
BEI-7526-0087-0032

Comments from DTSC-HERD, J. Polisini 2/20/2008

SPECIFIC COMMENTS	RESPONSE TO SPECIFIC COMMENTS
Specific Comment 1. The outline of the IR Site 24 sampling (Section 2.6.1, page 2-11), determination of no significant human health exposure pathways (Section 2.7.1, page 2-14) and analysis of ecological hazard (Section 2.7.2, page 2-15) appears to include all the stages of sediment investigation contained in the Remedial Investigation (RI) Report as well as an accurate summary of the evaluation of potential ecological hazard (Section 2.8, page 2-16). This comment is meant for the DTSC Project Manager and no response is required from the Navy or Navy consultants.	**Response to Specific Comment 1.** No response required.
Specific Comment 2. Remedial Goals (RGs) developed for the nearby SPL are referenced and proposed for use at IR Site 24 (Section 3.4, page 3-7) for sediment cadmium, total DDx and total PCBs. HERD placed several restrictions and directions for implementation on the SPL RGs which should be included in the IR Site 17 FS: a. *Draft Proposed Plan for Seaplane Lagoon (IR Site 17),* dated October 2005 in a HERD memorandum to Marcia Liao, November 18, 2005: "The sediment PCB RAO should be stated as sediment PCB concentration not to exceed 1.13 mg/kg in any single sediment confirmation sample with the area-wide average not to exceed 200 μg/kg. The 200 μg/kg total PCB sediment concentration is the San Francisco Regional Water Quality Control Board (SFRQCB) estimate of San Francisco Bay near-shore central-tendency total PCB concentration.";	**Response to Specific Comment 2.** a. The preliminary RG for total PCBs was revised to match that for IR Site 17. The following sentence has been added at the end of Section 3.4.3: "Consideration will be given to achieving an area-wide average total PCB concentration that is consistent with the upper bound nearshore ambient concentration for total PCBs (i.e., 0.2 mg/kg)."
b. *Draft Final Feasibility Study Report Seaplane Lagoon, Alameda Point, California* dated 27 May 2005 in a HERD memorandum to Marcia Liao dated June 28, 2005: "HERD accepts the cadmium sediment PRG of 24.4 mg/kg for the SPL, as a site-specific value, based on the calculation of mass reduction due to remedial action, which is still to be verified, the low incidence of benthic bioassay adverse effects and consideration of post-remedial action monitoring of SPL surface water cadmium concentrations at the sediment-water interface. This sediment cadmium concentration should not be used without site-specific verification and discussion with HERD at any other Navy site."; and,	b. Comment noted.

Comments from DTSC-HERD, J. Polisini 2/20/2008

SPECIFIC COMMENTS	RESPONSE TO SPECIFIC COMMENTS
Specific Comment 2 (continued). c. *Draft Feasibility Study Report Seaplane Lagoon, Alameda Point, California,* dated November 29, 2004 in a HERD memorandum to Marcia Liao dated February 2, 2005: "The cadmium PRG (Table 3-2, page 52) of 24.4 mg/kg is significantly above the 2.49 mg/kg sediment cadmium concentration (T50 regression value) that is the effect concentration that would give a response of 50 percent according to the logistic regression model applied to a national database of sediment effect concentrations (EPA, 2004, Table C-1, page C-9). Cadmium efflux from sediments into overlying water was demonstrated during SPL investigations. Cadmium in fish tissue is a risk driver in the SPL Baseline Ecological Risk Assessment (Section 2.5.1, page 23). Monitoring of SPL cadmium water concentrations at the sediment-water interface should be considered as part of any post-remediation conditions." HERD accepts use of the IR site 17 RGs based on the direction supplied above, which includes: 1) some monitoring or post-action sampling of cadmium concentrations at the sediment-water interface; or, 2) pore-water sampling to determine interstitial sediment concentrations of cadmium at locations with elevated cadmium sediment concentrations.	**Response to Specific Comment 2 (continued).** c. Alternatives 3, 4, and 5 were revised to include the collection of surface water samples for cadmium analysis as part of the predesign investigation, which may be conducted as the initial step in the remediation. The following sentence was added after sentence 1 in Sections 6.4.1.1, 6.5.1.1, and 6.6.1.1: "A predesign investigation may be implemented as the first step in the remediation." The following text was added after the fourth bullet in Section 6.4.1.1: • Collect an assumed four surface water samples in areas with elevated cadmium for analysis to evaluate cadmium efflux from sediment into overlying water. The following sentence was added at the end of Sections 6.4.1.2 and 6.5.1.4: "If predesign investigation results for cadmium efflux analysis indicate potential risk, then additional cadmium efflux sampling will be performed as part of the post-remediation monitoring program."
Specific Comment 3. The area south of Pier 3 is indicated as planned for transfer to the California Department of Fish and Game for use as a marina (Executive Summary, page ES-1; Section 2.2, page 2-2; Section 3.1, page 3-2). As a potential recipient of portions of IR Site 24, the Department of Fish and Game should be specifically requested to concur with the proposed remedial alternative for IR Site 24.	**Response to Specific Comment 3.** Copies of the Draft IR Site 24 Feasibility Study were sent to the California Department of Fish and Game and U.S. Fish and Wildlife Service. No comments were received from these agencies.

SPECIFIC COMMENTS	RESPONSE TO SPECIFIC COMMENTS
Specific Comment 4. The spatial co-occurrence of sediment cadmium and lead is proposed, along with the uncertainty associated with lead bioavailability, as the justification for not developing an ecological RG for lead (Executive Summary, page ES-4; Section 3.4, page 3-8). Given the co-occurrence of sediment cadmium and lead, remedial action for sediment cadmium will address the sample locations with the highest sediment lead concentration. The figures provided with this regression analysis indicate that remedial action to the proposed sediment cadmium RG (approximately 24.4 mg/kg) would remediate sediment lead to approximately 250 mg/kg for the 0-5 cm, 5-25 cm depths and 'all depths'. Some estimate of ecological hazard, to the representative species assessed in the Remedial Investigation Report, for a sediment lead concentration of 250 mg/kg should be presented in the FS Report.	**Response to Specific Comment 4.** An ecological risk estimate of the residual sediment lead concentrations was prepared for the surface sediment (0-5 cm) and subsurface sediment (5-25 cm). Based on the association of sediment cadmium and lead concentrations, the residual lead concentrations are expected to be less than 250 mg/kg. The ecological risk estimate of residual lead was based on an exposure point concentration (EPC) estimated by the 95 UCL of the mean, which is the same EPC used in the baseline risk assessment. The following text was added as new Section 3.4.4: **"Section 3.4.4 Lead Goal** As noted in Section 3.4, a preliminary RG for lead was not developed due to the associated uncertainties. Due to similar distributions of cadmium and lead, the cadmium preliminary RG is expected to reduce ecological risk associated with lead concentrations. To evaluate this expectation, the 2005/2006 surface sediment data set was revised eliminating four lead concentrations that are associated with sample locations where cadmium exceeds the preliminary RG. After removing these four values, the new sediment lead data set (n= 27) would range from 12 to 140 mg/kg with a mean of 46.4 mg/kg and a 95 percent upper confidence limit (UCL) of 75.7 mg/kg (calculated using U.S. EPA's ProUCL program). A hazard quotient was recalculated for the least tern (most sensitive ecological receptor) using the same exposure factors used in the RI report (except that the ingestion rate here is based on equations by Nagy (2001)) (Table 3-3). Using a SUF of 10 percent, the HQ based on the revised sediment EPC (HQ 14) is nearly equivalent to the HQ associated with the ambient concentrations (HQ 13). This evaluation shows that the cadmium preliminary RG will successfully reduce ecological risk associated with sediment lead concentrations." The following new table was added:

Comments from DTSC-HERD, J. Polisini 2/20/2008

SPECIFIC COMMENTS

Specific Comment 4 (continued).

RESPONSE TO SPECIFIC COMMENTS

Response to Specific Comment 4 (continued).

Table 3-3
Exposure Factors for Calculations of Revised Lead HQ for the Least Tern

Factors for Least Tern	Values and Units
Ingestion rate, food	0.00975 kg/day
Body weight	0.045 kg
Bioaccumulation factor	0.0173 kg-sediment/kg-food
Toxicity reference value, receptor-adjusted	0.0124 mg/kg-day
IR Site 24 lead exposure point concentration	75.7 mg/kg
Ambient lead concentration	43.2 mg/kg
Site use factor	10 percent

Specific Comment 5.

The Final Remedial Investigation Report for IR Site 20 and IR Site 24 is cited for the conclusion that while metals such as cadmium may be released from sediments into overlying waters, but that changes in reduction-oxidation (redox) conditions and dilution due to tidal action would result in dilution of chemical concentrations in overlying water (Section 2.6.2, page 2-14; Section 3.1, page 3-1) sufficient to reduce any ecological hazard to insignificant levels. However, cadmium efflux from sediments into overlying water was measured in the adjacent SPL sediments, although these measurements were not used to set the SPL RG for cadmium sediment. In addition, National Ambient Water Quality Criteria (NAWQC), and other water quality criteria (Section 3.3.1.2, page 3-6), for cadmium are indicated as surface water Applicable or Relevant and Appropriate Requirements (ARARs) in the event remedial action for sediment results in a discharge to surface waters. Some evaluation of cadmium efflux from IR Site 24 sediments should be performed prior to implementing the SPL cadmium RG at IR Site 17 or as a post-remediation monitoring requirement.

Response to Specific Comment 5.

Alternatives 3, 4, and 5 were revised to include the collection of surface water samples for cadmium analysis as part of the predesign investigation, which may be conducted as the initial step in the remediation.

The following sentence was added after sentence 1 in Sections 6.4.1.1, 6.5.1.1, and 6.6.1.1:

"A predesign investigation may be implemented as the first step in the remediation."

The following text was added after the fourth bullet in Section 6.4.1.1:

- collect an assumed four samples for cadmium analysis to evaluate cadmium efflux from sediment into overlying water

The following sentence was added at the end of Sections 6.4.1.2 and 6.5.1.4:

"If predesign investigation results for cadmium efflux sampling indicate potential risk, then additional cadmium efflux sampling will be performed as part of the post-remediation monitoring program."

RESPONSE TO COMMENTS ON
DRAFT FEASIBILITY STUDY REPORT, IR SITE 24
ALAMEDA POINT, ALAMEDA, CALIFORNIA
DATED NOVEMBER 2007
BEI-7526-0087-0032

Comments from DTSC-HERD, J. Polisini 2/20/2008

SPECIFIC COMMENTS	RESPONSE TO SPECIFIC COMMENTS
Specific Comment 6. Use of the updated food ingestion equation (Nagy, et al., 2001) rather than the previous equation (Nagy et al., 1999) results in a least tern food ingestion rate (IR_{food}) which is 16.8% greater [i.e., 0.0097 kg/day (Nagy, 2001) vs. 0.0083 kg/day (Nagy, 1999)]. If this ratio for increased food intake is applied to the proposed cadmium RG of 24.4 mg/kg, the proposed cadmium RG would be approximately 20.8 mg/kg. HERD routinely recommends that the more recent food ingestion equations (i.e., Nagy, 2001) be used for calculating avian and/or mammalian food intake rates. Please expand the discussion of least tern food intake to clearly state which equation was used to develop the least tern food intake rate and any modifications required in the proposed SPL cadmium RG.	**Response to Specific Comment 6.** Text in paragraph 8 of Section 3.4 of the Draft FS Report clearly states that the RG is based on the food ingestion equation of Nagy et al. (1999). It also states that there is an updated version of the ingestion equation based on Nagy et al. (2001). Both ingestion rates are presented. The text describes the difference between the two ingestion rates as relatively small based on the range of sediment concentrations. The 16.8 percent difference between ingestion rates represents no change in the proposed sediment removal volumes or the FS results. None of the sediment samples used to estimate sediment volume in the AOEC have concentrations between the proposed RG of 24.4 mg/kg and the 20.8 mg/kg value. The following sentence was added to the end of paragraph 8 of Section 3.4: "For cadmium, an RG value of 20.8 mg/kg would be calculated using the updated ingestion equation, which is similar to the proposed RG of 24.4 mg/kg and would achieve the same RAO because there are no cadmium concentrations at IR Site 24 between these two values."
Specific Comment 7. Please provide a regression analysis for total PCB and total DDx, similar to that presented for sediment lead and cadmium (Figure 3-2), in support of the 'similar spatial distribution' comment (Section 3.4.2, page 3-9).	**Response to Specific Comment 7.** Because a preliminary RG is presented for both total PCBs and total DDx, a correlation analysis is not warranted and was not performed. The last sentence in the second paragraph of Section 3.4.2 was replaced with the following text: "In addition, the spatial distribution of total DDx concentrations in sediment in the AOEC is similar to that for PCBs. (A review of Table 2-2 shows that the five sediment samples containing the highest total DDx values also contain the five highest total PCB values.) Therefore, the use of the preliminary RG for PCBs is expected to reduce the potential ecological risk due to total DDx concentrations as well." Tables 2-2 and 2-3 were updated to show data for total DDx as estimated by the total of 2,4'-DDx and 4,4'-DDx. Table 3-1 was updated to specify the range of concentrations at IR Site 24 for surface sediment for all years, which is consistent with the range used for IR Site 17.

Comments from DTSC-HERD, J. Polisini 2/20/2008

SPECIFIC COMMENTS	RESPONSE TO SPECIFIC COMMENTS
Specific Comment 8. HERD defers to the DTSC Risk Manager for evaluation of the sequential hierarchy applied to risk management criteria (Section 4.3, page 4-3) of effectiveness, followed by implementability and then by cost. This comment is meant for the DTSC Project Manager and no response is required from the Navy or Navy consultants.	**Response to Specific Comment 8.** No response required.
Specific Comment 9. The sites-specific sedimentation rate for IR Site 24 is unknown (Section 4.3.4, page 4-8). Lack of a site-specific sediment rate introduces some uncertainty into the Monitored Natural Recovery remedial alternative. This comment is meant for the DTSC Project Manager and no response is required from the Navy or Navy consultants.	**Response to Specific Comment 9.** No response required.
Specific Comment 10. HERD agrees that the proposed IR Site 24 RGs listed (Table 3-2) are those developed for the SPL, IR Site 17. However, the footnotes listing the formula used to calculate the Preliminary Remediation Goals (Table 3-2) appears to be in error. The formula RG = (TRV*VW)/(SUF * IR * BAF), has no sediment concentration term which would be used by applying the bioaccumulation factor (BAF) to develop a food ingestion concentration. Please amend the formula.	**Response to Specific Comment 10.** The RG formula in Table 3-2 was revised as follows: preliminary RG = $(BW*TRV*SUF^{-1})/([IR_{FOOD}*BAF]+IR_{SED})$ where: preliminary RG = sediment ecological preliminary remediation goal (sediment concentration) BW = receptor body weight TRV = toxicity reference value SUF = receptor site use factor IR_{FOOD} = receptor ingestion rate for food BAF = sediment-to-food bioaccumulation factor IR_{SED} = receptor ingestion rate for incidental sediment

RESPONSE TO COMMENTS ON DRAFT FEASIBILITY STUDY REPORT, IR SITE 24 ALAMEDA POINT, ALAMEDA, CALIFORNIA DATED NOVEMBER 2007 BEI-7526-0087-0032

Comments from DTSC-HERD, J. Polisini 2/20/2008

CONCLUSIONS	RESPONSE TO CONCLUSIONS
Specific Comment 10 (continued). HERD accepts the Sea Plane Lagoon reports as the source of the proposed sediment Remedial Goals for IR Site 24 based on geographic proximity and similarity of habitat. However, the potential effect of a different least tern ingestion rate, evaluation of potential cadmium efflux to overlying water, and the proposed co-location of elevated DDx and PCB remain to be addressed. HERD accepts the focus of the Remedial Goals on ecological receptors given the extremely limited direct or indirect potential for human exposure to IR Site 24 sediments. Specific concurrence to the IR Site 24 Feasibility Study Report should be requested from the California Department of Fish and Game, as a potential transfer recipient, of portions of IR Site 24.	**Response to Specific Comment 10 (continued)** Comment noted.

RESPONSE TO COMMENTS FROM DTSC-PM ON DRAFT FS REPORT

DRAFT RESPONSE TO COMMENTS ON
DRAFT FEASIBILITY STUDY REPORT, IR SITE 24
ALAMEDA POINT, ALAMEDA, CALIFORNIA
DATED NOVEMBER 2007
BEI-7526-0087-0032

Comments from DTSC-PM, D. Lofstrom 3/03/2008 and 4/17/08

GENERAL COMMENTS	RESPONSE TO GENERAL COMMENTS
General Comment 1: March 3, 2008 DTSC will be reviewing the ARARs as presented in the Draft FS and will provide comments or concurrence prior to issuance of the Draft Final FS.	**Response to General Comment 1.** Comment noted.
General Comment 2: April 17, 2008 DTSC has reviewed the ARARs in the Site 24 Draft FS and concurs with the ARARs.	**Response to General Comment 2.** Thank you. The FS statement that DTSC did not respond to the Navy's ARARs letter was revised to state that DTSC reviewed the IR Site 24 ARARs and is in agreement with them.

RESPONSE TO COMMENTS FROM ARRA ON DRAFT FS REPORT

RESPONSE TO COMMENTS ON DRAFT FEASIBILITY STUDY REPORT, IR SITE 24 ALAMEDA POINT, ALAMEDA, CALIFORNIA DATED NOVEMBER 2007 BEI-7526-0087-0032

Comments from ARRA, D. Potter 2/7/2008

GENERAL COMMENTS	RESPONSE TO GENERAL COMMENTS
General Comment 1. **Surface sediments are as contaminated as deeper sediments.** In 2005 and 2006, the Navy collected and analyzed sediment samples from three depths at each of 31 locations in IR Site 24: surface (0 to 2 inches), deeper (2 to 10 inches), and deepest (10 to 20 inches). *FS* Figure 3-1 shows that four of these locations are within IR Site 24's AoEC (Area of Ecological Concern). *FS* Table 2-2 presents analytical results for sediment samples from these locations. The results confirm that sediments within the AoEC are contaminated: AoEC sediment concentrations for 13 CoPECs (Chemicals of Potential Ecological Concern) are higher than at the reference location (PA C-12), which is outside of IR Site 24. For PCBs, tributyltin, cadmium, and lead, surface sediment concentrations are greater than the ER-M (effects range-median) at all four AoEC sample locations.[1] In the case of HPAH6, surface sediment concentrations exceed the ER-M at three of the four AoEC locations, and in the case of DDx, at two of the four locations. In IR Site 24's AoEC, surface sediment is about as contaminated as deeper sediment. Ten CoPECs are at least as contaminated in the surface sediment sample as in the corresponding deeper sample at two or more of the four AoEC sample locations. These CoPECs that are prominent in surface sediment are HPAH6, LPAH6, DDx, PCBs, tributyltin, cadmium, chromium, copper, lead, and zinc. Deposition of particulate matter causes sediment to build up in many aquatic environments, especially in the absence of high-energy forces such as strong currents or waves. The *FS* assumes these forces to be minimal at IR Site 24's AoEC. Thus, the widespread occurrence of surface sediment that is about as contaminated as deeper sediment is unexpected, because the *FS* states that source of contaminated particulate matter (the storm drain line leading to Outfall J) has been abated. Two possible explanations for contamination in the surface sediment are: (1) the depositional environment at the AoEC is poorly understood, and (2) ongoing discharges from Outfall J continue to contain suspended contaminants that deposit as sediment in IR Site 24's AoEC.	**Response to General Comment 1.** The analytical data generally show that metals concentrations in the AOEC are higher in the deeper (5–25 and 25–50 cm) sediments than in the shallow sediments. In response to this comment, a new Section 2.2.2 has been added to the FS Report to provide additional information on the storm drain system leading to Outfalls J, K, and L at IR Site 24. Storm drain work has been conducted through 2001, and results show that continuing onshore sources of contaminants to IR Site 24 have been controlled. The following new references cited in the new section were added in Section 8 of the FS Report: Department of the Navy. 1996. Naval Air Station Alameda, Site 18 Fact Sheet, Number 8. December. Tetra Tech EM Inc. 2001. Storm Sewer Study, Technical Memorandum Addendum and Response to Agency Comments on the Draft Final Storm Sewer Study Report, Alameda Point, Alameda, California. August 30. Tetra Tech EM Inc. 2002. Data Summary Report, Supplemental RI, Data Gap Sampling for Operable Units 1 and 2. July 25. Site-specific data on sedimentation rates in this area near and beneath the wharf road are not available.

[1] *Final Remedial Investigation Report, IR Site 20 (Oakland Inner Harbor) and IR Site 24 (Pier Area), Alameda Point, California.* Navy, August 30, 2007, Tables 4-8 and 4-9. (ER-M is not applicable to tributyltin. Table 4-9 uses the value reported by Weston, 1996, as the threshold value for this substance.)

Comments from ARRA, D. Potter 2/7/2008

<table>
<tr><th>GENERAL COMMENTS</th><th>RESPONSE TO GENERAL COMMENTS</th></tr>
<tr><td>General Comment 1 (continued)

• The FS assumes deposition is occurring at IR Site 24's AoEC.

"The sedimentation rate at IR Site 24 is currently unknown; the sedimentation rate at nearby IR Site 17 (Seaplane Lagoon) has been estimated at approximately 0.6 to 0.7 inches (1.5 to 1.7 cm) per year (Battelle 2005). Monitored Natural Recovery (MNR) is considered appropriate for the AOEC at IR Site 24 because this area is protected from high-energy forces such as boat wakes, propeller scour, keel drag, or large-boat anchoring that would minimize the effectiveness of the natural sedimentation process." (FS, p. 4-8)

Given the presence of contamination in surface sediment at IR Site 24's AoEC, it is difficult to account for ongoing sedimentation, except by contaminated particulate matter. At a sedimentation rate of 0.6 to 0.7 inches per year, at least six inches of clean sediment should have accumulated. This clean layer is not apparent in the sediment sampling results. In contrast to the FS's conceptual model, perhaps episodic, intense storms create high energy conditions at Outfall J that erode newly deposited surface sediment. Thus, the contamination in surface sediments that was observed in the 2005 and 2006 samples may have been deposited long ago, while the Navy was active at Alameda Point. Possibly, periodic storm-induced scouring prevented this historically contaminated sediment from being covered by later sedimentation.

• The FS discounts the possibility that Outfall J could be a continuing source of contamination.

"The storm drain line leading to Outfall J was cleaned and inspected in 1991 (TtEMI 1996); this line served buildings located east of IR Site 24 in Environmental Baseline Survey (EBS) Parcels 154 and 201. The largest buildings in EBS Parcels 154 and 201 are Buildings 166 and 167, which were historically used as aircraft maintenance hangars. Activities conducted in these buildings reportedly included painting, resin mixing, parts washing in solvent dip tanks, metals machining, paint stripping/sandblasting, aircraft defueling and refueling, and replacing or</td><td>Response to General Comment 1 (continued)</td></tr>
</table>

Comments from ARRA, D. Potter 2/7/2008

GENERAL COMMENTS	RESPONSE TO GENERAL COMMENTS
General Comment 1 (continued) filling of lubrication and hydraulic fluids. The open spaces of EBS Parcels 154 and 201 were historically used for aircraft parking and maintenance and for chemical, equipment, and material storage, which included hazardous material storage yards and an industrial dust silo (BEI 2007b). It is suspected that industrial wastewaters and potentially contaminated surface runoff from the parcels may have discharged through storm drain lines leading to IR Site 24 (TtEMI 2006b). Further evaluation of the northern portion of EBS Parcel 154 near Building 167, as well as evaluation of the sediment in the storm sewer segment that originates south of Building 167, was recommended in a site inspection report that was completed in August 2007 (BEI 2007b). No further evaluation, beyond an evaluation of the aircraft parking and staining areas, was recommended for EBS Parcel 201 (BEI 2007b)." (*FS*, p. 2-2, emphasis added) The further evaluation recommended in BEI 2007b2[2] is warranted, but this work cannot rule out Outfall J as a continuing source of contaminated surface sediment to IR Site 24's AoEC. Even if the storm drain line leading to Outfall J was flawlessly cleaned and inspected in 1991, Navy operations at Naval Air Station Alameda continued beyond that date, until 1997, during which time recontamination of the storm drain system could have occurred. Thorough cleaning, inspection, and sampling sometimes can justify the inference that a storm drain line is free of contamination. However, when persuasive information to the contrary exists, such as contaminated surface sediments at the outfall, the inference is unreliable, and further assurance is needed. **Recommendation:** Revise the dredging alternative (Alternative 5) to include a surface sediment monitoring five wet-weather seasons after dredging of the AoEC is completed.	**Response to General Comment 1** (continued)

[2] *Final Site Inspection Report, Transfer Parcel EDC-12, Alameda Point, California.* Navy, October 10, 2007, pp. 7-4 to 7-6. (The original quote cites the draft final version of this document.)

RESPONSE TO COMMENTS ON
DRAFT FEASIBILITY STUDY REPORT, IR SITE 24
ALAMEDA POINT, ALAMEDA, CALIFORNIA
DATED NOVEMBER 2007
BEI-7526-0087-0032

Comments from ARRA, D. Potter 2/7/2008

GENERAL COMMENTS	RESPONSE TO GENERAL COMMENTS
General Comment 2. **The area drained through Outfall J is very large and the condition of its storm drain lines is not completely known.** The *FS* implies that the storm drain line discharging through Outfall J serves EBS Parcels 154 and 201 only. (For example, see the underlined passage in the quote in Comment 1, from *FS* page 2-2.) This implication is very misleading. According to the Alameda Point storm sewer study, the storm drain lines that discharge through Outfall J serve a much greater area.[3] Lands tributary to Outfall J include much of OU-2A and OU-2B: specifically, Outfall J serves all of IR Sites 13, 19, and 22; most of IR Sites 4, 9, 23, and 27; and a portion of IR Sites 3, 11, and 35. Additionally, Outfall J drains all or portions of EBS parcels 134, 138, 139, 141, and 164, which are not within IR sites. The same heavy metals, PAHs, and PCBs that are found in surface sediment at Outfall J are principal contaminants in many of these IR sites. According to the Alameda Point storm sewer study, the condition of some storm drain line segments discharging through Outfall J is unknown. The *FS* should objectively discuss the likelihood that former storm sewer inspection and cleaning completely removed all contamination from the storm drain lines upstream of Outfall J. **Recommendation:** Revise the *FS* to disclose that Outfall J drains a much greater area of former industrial activity than EBS Parcels 154 and 201, and that the condition of some segments of the storm drain lines upstream of Outfall J is unknown.	**Response to General Comment 2.** The FS Report has been revised to clarify the area drained by Outfall J. See Response to General Comment 1 above. New Section 2.2.2 includes information on the drainage boundaries of Outfall J and condition of the storm drain lines leading to Outfall J.

[3] *Storm Sewer Study Technical Memorandum Addendum and Response to Agency Comments on the Draft Final* Storm Sewer Study Report, Alameda Point, Alameda, California. Navy, August 30, 2001, Figure 1.

Comments from ARRA, D. Potter 2/7/2008

GENERAL COMMENTS	RESPONSE TO GENERAL COMMENTS
Summary Surface sediments at IR Site 24's AoEC are contaminated with heavy metals, PAHs, PCBs, and DDx. Possibly, this contamination is in historically contaminated sediment that has not been covered by more recent sedimentation. However, another likely explanation is that the storm drain system tributary to Outfall J is a continuing source of contamination to sediment at IR Site 24's AoEC. It is impractical to prove that the storm drain line system that Outfall J serves is not a continuing contaminant source. An effective way of assuring that no future sediment contamination from Outfall J would be to modify the Alternative 5 (Dredging) to include followup sediment sampling. Surface sediment sampling should be conducted five wet-weather seasons after the dredging of IR Site 24's AoEC has been completed.	**Response to Summary** See Responses to General Comments 1 and 2 above.

RESPONSE TO COMMENTS FROM U.S. EPA ON DRAFT FINAL FS REPORT

RESPONSE TO COMMENTS ON
DRAFT FINAL FEASIBILITY STUDY REPORT, IR SITE 24
ALAMEDA POINT, ALAMEDA, CALIFORNIA
DATED SEPTEMBER 2008
BEI-7526-0087-0048

Comments from U.S. EPA, Xuan-Mai Tran 9/17/08 and 9/22/08

COMMENTS: 9/17/08	RESPONSES TO COMMENTS
Comment 1. Response to General Comment 1 and Specific Comments 15, 16, 34 and 35: EPA does not think that Alternative 2 (Institutional Controls (ICs) alone) meets the threshold criterion of overall protection of human health and the environment. The Navy essentially concedes this in its response to General Comment 1, saying that ICs alone "are not intended to reduce ecological risk," but rather to keep it from increasing. Additionally, the current draft version, Section 6.3.2.1, states that with ICs, it is not known when RAOs will be achieved. This underlines the concern that RAOs are currently not being achieved, and it cannot be assumed that they will ever be achieved with ICs alone. If the Navy is unwilling to change the document to indicate that Alternative 2 does not meet the protectiveness criterion, EPA requests that a sentence be added to Section 6.3.2.1 and to Section 7.1 stating that EPA does not concur that Alternative 2 meets the threshold protectiveness criterion.	**Response to Comment 1.** The following text has been added at the end of Sections 6.3.2.1 and 7.1 and in a footnote to Table ES-1: "EPA does not concur that Alternative 2 meets the threshold protectiveness criterion." The following text from Section 6.6 of the Final RI Report has been added to support the existing text after the second sentence of Section 6.3.2.1: "The potential for risk in the AOEC is expected to be limited in scope due to the small size of the area and the location of the sediment shelf under the roadway, where exposure to receptors is likely to be minimal."
Comment 2. Response to General Comment 3: Although the distribution of lead and cadmium are similar, the response indicates that there is one location where this is not true (PA C-25), so it is unclear how a remedial goal (RG) would be developed to address this area. Please clarify.	**Response to Comment 2.** The third sentence in the response to EPA General Comment 3 has been clarified, and now reads as follows: "All of the locations in the remediation area that have lead concentrations exceeding the ERM also have cadmium concentrations exceeding the ERM."
Comment 3. Response to General Comment 5 and Specific Comments 21 and 24: The information in the second paragraph of the response to General Comment 5 should be included in the text, but it does not appear that this will be done, based on the revised text quoted in the response. Please include the information provided in the second paragraph of the response in the text of the FS.	**Response to Comment 3.** This information is included in Section 6.4.1.2 of the FS.
Comment 4. Response to Specific Comment 2: The response states that additional information regarding the storm lines was included in Section 2.2, but the provided text does not state whether there was sediment in the distal ends of the storm drains (i.e., between the outfall and the last manhole.) Since closed circuit television (CCT) was used, sediment may have been visible beyond the manhole (we understand that this may not have extended all of the way to the outfall). Please discuss whether there was sediment visible on the CCT scan in the vicinity of the last manhole for storm drain lines leading to Outfalls J, K, and L.	**Response to Comment 4.** The available level of detail documenting storm drain cleaning and removal is specified in the Storm Sewer Study Technical Memorandum (Tetra Tech EM Inc. 2001) and Data Summary Report, Supplemental RI, Data Gap Sampling for Operable Units 1 and 2 (Tetra Tech EM Inc. 2002), which were referenced in the FS.

RESPONSE TO COMMENTS ON
DRAFT FINAL FEASIBILITY STUDY REPORT, IR SITE 24
ALAMEDA POINT, ALAMEDA, CALIFORNIA
DATED SEPTEMBER 2008
BEI-7526-0087-0048

Comments from U.S. EPA, Xuan-Mai Tran 9/17/08 and 9/22/08

COMMENTS: 9/17/08	RESPONSES TO COMMENTS
Comment 5. Response to Specific Comment 23: The Navy is adding language, "ICs would remain in place until RAOs were achieved or the Navy and regulatory agencies agreed that the site no longer posed potentially unacceptable ecological risk." The "or" should be changed to "and." This also comes up in response to Specific Comments 25, 27, 30 and 31.	**Response to Comment 5.** The word "or" has been changed to "and" in these text sections.
COMMENTS: 9/22/08	**RESPONSES TO COMMENTS**
Comment 1. Text has been added to Section 2.7.1, summarizing the results of the human health risk assessment presented in the RI Report. However, the Remedial Action Objective (RAO) bullets were not revised. Please revise the RAO bullets on page 3-4.	**Response to Comment 1.** The following text was added as a new RAO bullet: "Reduction of potential biomagnification of Total PCBs in organisms higher in the food chain."
Comment 2. The response to Specific Comment 25 provides revised text that includes the "sedimentation rate of 0.3 cm per year," but the response to General Comment 5 indicates that the sedimentation rate is 0.3 inch per year. Please resolve this discrepancy.	**Response to Comment 2.** The correct value is 0.3 inch per year. The response to Specific Comment 25 was corrected, and a global search was conducted to verify 0.3 inch per year is used throughout the FS.
Comment 3: The response to Specific Comment 28 concludes that "disturbance of sediment associated with piling repairs is expected to be minimal." This assumption may be correct, but a work barge and tugboats may be needed to support piling repair work. These vessels produce large thrust and high velocity prop discharge that could disturb the shallow sediment, including sediment beneath the pier and wharf road. However, additional limitations on maneuvering these types of vessels near the wharf and pier support structures could be included during the RD.	**Response to Comment 3.** The response to Specific Comment 28 was revised to delete the last sentence: "If the pilings supporting the road need repair, the disturbance of sediment associated with piling repairs is expected to be minimal."

RESPONSE TO COMMENTS FROM DTSC-HERD ON DRAFT FINAL FS REPORT

RESPONSE TO COMMENTS ON
DRAFT FINAL FEASIBILITY STUDY REPORT, IR SITE 24
ALAMEDA POINT, ALAMEDA, CALIFORNIA
DATED SEPTEMBER 2008
BEI-7526-0087-0048

Comments from DTSC-HERD, J. Polisini 9/17/08

COMMENTS	RESPONSES TO COMMENTS
Comment 1. Response to HERD Specific Comment number 2 and 5: The response indicates that the text has been modified (Sections 6.4.1.1; 6.5.1.1 and 6.6.1.1) to state that a pre-design investigation of cadmium efflux from sediments to overlying water may be implemented. A potential post-remediation cadmium efflux monitoring program is then stated as dependent on the results of the pre-design investigation. HERD offered the alternative (Specific Comment number 5) of either pre-implementation evaluation or post-remediation monitoring of cadmium efflux into overlying water. If the post-remediation monitoring is dependent on the pre-design investigation, the word may should be revised to will.	**Response to Comment 1.** For consistency, the word "may" was changed to "would" in the referenced text in Sections 6.4.1.1, 6.5.1.1, and 6.6.1.1, and the sentence below was revised for clarity, as follows. "The pre-design investigation would be conducted either prior to the design or as the first step in the remediation."
Comment 2. Response to HERD Specific Comment number 2: The response indicates that 'consideration will be given…' to the 200 μg/kg area-wide total Polychlorinated Biphenyl (PCB) concentration as part of the total PCB Remedial Goal (RG). The level of consideration is not defined in this response. HERD recommends that the RG for total PCB be stated as 'The total PCB concentration not to exceed 1.13 mg/kg in any single sediment confirmation sample with the goal of an area-wide average not to exceed 200 μg/kg.	**Response to Comment 2.** For consistency with the IR Site 17 ROD, the following sentence has been added directly after the quoted sentence in the executive summary (on page ES-4), at the end of Section 3.4.3, and at the end of footnote 2 in Table 3-2: "The area-weighted average total PCB concentrations within IR Site 24 following remediation will be comparable to the upper bound estimate (i.e., 0.2 mg/kg) of the nearshore ambient concentration calculated for the San Francisco Bay area."
Comment 3. Response to HERD Specific comment number 3: The area south of Pier 3 is indicated as planned for transfer to the California Department of Fish and Game for use as a marina (Executive Summary, page ES-1; Section 2.2, page 2-2; Section 3.1, page 3-2). The RTC indicates that the Department of Fish and Game was furnished a copy of the Draft IR Site 24 FS Report, but did not respond with comments. As a potential recipient of portions of IR Site 24, the Department of Fish and Game should be specifically requested to concur with the proposed remedial alternative for IR Site 24.	**Response to Comment 3.** The California Department of Fish and Game will be provided a copy of the draft IR Site 24 Proposed Plan for review.

ATTACHMENT A

MEMORANDUM OF AGREEMENT BETWEEN THE UNITED STATES DEPARTMENT OF THE NAVY AND THE CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL

Memorandum of Agreement Between
The United States Department of the Navy and
The California Department of Toxic Substances Control

Use of Model "Covenant to Restrict Use of Property" at Installations Being Closed and Transferred by the United States Department of the Navy

1. Background

a. The purpose of this Memorandum of Agreement (MOA) is to formalize the use of two model environmental restriction covenants (attached) that have been drafted during negotiations between representatives of the United States Department of the Navy (DON) and the California Department of Toxic Substances Control (DTSC).

b. Under CERCLA Sec. 104, as delegated to DON by E.O. 12580, and implemented pursuant to the National Contingency Plan (NCP – 40 CFR Sec. 300 et seq.) and 10 USC Sec. 2701, et seq., the cleanup of hazardous substances, pollutants and contaminants is required to be at a level that protects human health and the environment. As a result, this protection can be achieved at certain sites by the imposition of "institutional controls" (i.e., ICs – legal mechanisms to protect human health and the environment by restricting access or exposure to the contaminants in question) with or without underlying "engineering controls" (i.e.; ECs – engineered mechanisms such as a cap on a landfill, designed to physically insure access or exposure to the contaminants in question is prevented). Collectively these ICs and ECs are called "land use controls" (LUCs).

c. In the case of property being closed and transferred by DON to a nonfederal entity, it is necessary to insure that these LUCs stay in place and are honored by all future owners and occupants of the property in question, for as long as contamination is present at levels that do not permit unrestricted use. One key way such LUCs can be maintained is by DON's retention of sufficient legal title and interest to insure continuing enforcement of the terms of the LUCs. This retention would entail burdening such conveyances of title with deed covenants insuring that the deed transferring such property contain a formal restriction – a restrictive covenant – on the use of the property that will "run with the land," and is enforceable against the "servient estate" (i.e., all future owners of the land) and is retained by the United States, as represented by DON, acting as holder of the "dominant estate." In addition, DON can convey a separate and similar restrictive covenant to DTSC as provided in

Section 2 below.

d. In the State of California, such a restriction on the use of land, to protect human health and the environment is recognized by Section 1471 of the California Civil Code. This statute characterizes such a restrictive covenant as an "environmental restriction" and requires such words to be placed in the title of the document creating such an interest. DON has agreed to include such restrictive language in the deeds it executes where it imposes LUCs as a remedy under applicable law.

e. Similar to CERCLA, State environmental protection laws recognize the availability of using LUCs as remedies to protect human health and the environment. Currently, DTSC's authority under Chapter 6.5 and 6.8 of Division 20 of the California Health and Safety Code, provides statutory avenues to impose LUCs at a cleanup site to insure that the LUCs are honored by future owners. Chapter 6.5 is generally used when the cleanup site in question is one subject to the State's authorities under the hazardous waste facilities law, and Chapter 6.8 is generally used when the cleanup site in question is one subject to the State's equivalent to the federal CERCLA program.

f. In the case of property being closed and transferred to a nonfederal entity by DON where a cleanup remedy has used LUCs as a remedy as described above, DON and DTSC have a mutual interest in insuring that the "environmental restriction" imposed on the land is enforced for however long the protection of public health and the environment requires such restrictions.

g. As a result, DON and DTSC agree that it is in both parties' and the public's interests, that DTSC be in a position to enforce the "environmental restrictions" that the DON will be imposing on these transferring parcels of property. To this end, in addition to retaining the power to enforce protective covenants, DON agrees to convey a separate power to enforce such restrictive covenants to DTSC equivalent to DON's power to enforce any "environmental restrictions" burdening the transferring property by entering into a "Covenant to Restrict Use of Property." Under both Chapter 6.5 and Chapter 6.8, DTSC has the authority to monitor and enforce such "environmental restrictions" conveyed to it by the owner of property on which such an "environmental restriction" has been found necessary. Therefore, in consideration of DON's conveying such an interest, DTSC may implement as appropriate the various statutory authorities it possesses under Chapter 6.5 and Chapter 6.8 (as applicable) to insure these "environmental restrictions" are honored by all future owners and occupants.

2. Terms of Understanding:

a. DON and DTSC agree that in all future property transfers to a nonfederal agency, where DON is acting on behalf of the United States as the transferring or disposing agent, the applicable model "Covenant to Restrict Use of Property" attached to this MOU will be used throughout California when the proposed remedy involves imposing an IC (except those "early transfers" where 1) the transferee will perform the cleanup, and 2) the cleanup includes an IC in the remedy, and 3) has executed an order or enforceable agreement with DTSC or has entered into a Sec. 25222.1 agreement with DTSC, that calls for the transferee entering into a "Covenant to Restrict Use of Property" directly with DTSC).

b. DON and DTSC have entered into a number of Federal Facility Agreements and Federal Site Remediation Agreements for DON property. These Agreements generally call for coordination of the DON's satisfaction of its corrective action obligations under the Resource Conservation and Recovery Act (RCRA) and Health and Safety Code section 25200.10 with its responsibilities under CERCLA section 120(i), EO 12580, the Defense Environmental Restoration Program and the NCP. The Agreements recognize that the DON may satisfy some or all of its corrective action obligations through CERCLA response actions. Where such corrective action at hazardous waste management units is being satisfied through CERCLA, Attachment A shall be used. Attachment B is the model which will be used for hazardous waste management facilities not addressed in Federal Site Remediation or Federal Facility Agreements.

c. When issuing Proposed Plans for public comment, DON will attach a copy of this MOU and the appropriate model "Covenant to Restrict Use of Property" so as to assure the public that the specific LUC being proposed will be enforced, in part, by DON's retained power to enforce the deed covenants and conveyance of the power to enforce protective deed covenants to DTSC contemporaneously with the execution of the deed transferring DON's interests to the new owner.

d. In using these models to draft the appropriate "Covenant to Restrict Use of Property," DON's and DTSC's personnel will work collaboratively to develop the specific information applicable to the given site called for by Articles I (Statement of Facts) and IV (Restrictions) of the attached models. A final "Covenant to Restrict Use of Property" that is ready for signature for a given site, will be prepared in time to allow it to be

executed contemporaneously with the execution of the deed transferring DON's non-retained interests in the property to the new owner. In the case of "early transfers" where DON is performing the cleanup after the transfer, and is imposing an LUC at the time of the "early transfer" in support of its ongoing cleanup activities, the Parties recognize that the contents of Articles I and IV of the model covenants for such sites will likely not be as detailed as that suggested in the attached models. The degree of detail contained within the model covenant will be the information available as to the cleanup site, although the covenants must be adequate to protect human health and the environment to allow an early transfer. The form of remedy and any additional associated IC will be more fully developed once the remedy is selected and implemented.

e. The Parties recognize that given the need to tailor the terms of the "environmental restriction" to the remedy that is finally selected after seeking public comment on the Proposed Plan, the terms of the final "Covenant to Restrict Use of Property" may vary greatly from the draft proposal. The Parties recognize that the public should be given specific notice of this fact in the Proposed Plan.

f. The Parties recognize that remedies proposed by the DON will be submitted to DTSC for concurrence. However, there may be unresolved disagreements at some cleanup sites concerning the remedy being proposed by DON including, in particular, the scope and nature of the LUCs, and the terms of any underlying, proposed "Covenant to Restrict Use of Property." In such situations the Parties will use their best efforts to resolve all disputes informally. If the Parties are ultimately unable to resolve the issue in dispute, DON and DTSC reserve any rights they might have to take any action available under applicable state or federal law.

g. Either Party may terminate its involvement in this Agreement by giving thirty (30) days written notice to the other Party. Upon receipt of notice and the expiration of thirty days termination shall occur by operation of law.

Signed: F.R. Ruehe — 10 MARCH 2000

F.R. Ruehe
Rear Admiral
United States Navy
Commander Navy Region Southwest

Date: 10 MARCH 2000

Signed: Edwin F. Lowry 3/10/00
Edwin F. Lowry
Director
Department of Toxic Substances Control
Date

Attachment A: Model Site Mitigation Program "Environmental Restriction Covenant and Agreement"

Attachment B: Model Hazardous Waste Management Program/State Regulated Unit "Environmental Restriction Covenant and Agreement"

Approved as to form:

Date: 9 March 00 By: Mary Kay Faryan

Approved as to form:

Date: March 16, 2000 By: [illegible] Thomas

MODEL SITE MITIGATION PROGRAM

DEED RESTRICTION

RECORDING REQUESTED BY:
[Covenantor's Name]
[Street Address]
[City], California **[Zip Code]**

WHEN RECORDED, MAIL TO:

Department of Toxic Substances Control
Region ___
[Street Address]
[City], California **[Zip Code]**
Attention: **[Name of Branch Chief]**, Chief
[Branch Designation]

SPACE ABOVE THIS LINE RESERVED FOR RECORDER'S USE

COVENANT TO RESTRICT USE OF PROPERTY

ENVIRONMENTAL RESTRICTION

(Re: *[Insert parcel number(s) and name of site property to be restricted.]*)

This Covenant and Agreement ("Covenant") is made by and between the United States of America acting by and through the Department of the Navy ("DON") (the "Covenantor"), the current owner of property situated in *[city]*, County of [ ], State of California, described in Exhibit "A", attached hereto and incorporated herein by this reference (the "Property"), and the State of California acting by and through the Department of Toxic Substances Control (the "Department"). Pursuant to Civil Code section 1471(c), Health and Safety Code Sections 25222.1 and 25355.5 the

Department has determined that this Covenant is reasonably necessary to protect present or future human health or safety or the environment as a result of the presence on the land of hazardous materials as defined in Health and Safety Code ("H&SC") section 25260. In addition, pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 104 (42 USC Section 9604), as delegated to the Covenantor by E.O. 12580, ratified by Congress in 10 USC Sec. 2701, et seq., and implemented by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP – 40 CFR Part 300) and implementing guidances and policies, the Covenantor has also determined that this Covenant is reasonably necessary to protect present or future human health or safety or the environment as the result of the presence on the land of hazardous substances, pollutants and contaminants as defined in CERCLA Section 101 (42 USC Section 9601).

The Covenantor and the Department, collectively referred to as the "Parties", therefore intend that the use of the Property be restricted as set forth in this Covenant, in order to protect human health, safety and the environment.

The Covenantor retains sufficient legal title and interest in the subject property to insure continuing enforcement of the protective covenants and agreements contained within this Covenant to Restrict the Use of Property. Further in any subsequent transfers or conveyance of title to nonfederal entities the DON shall burden the property with additional deed covenants that insure that any subsequent deed or transfer contains the protective covenants and right of access and power to conduct monitoring of wastes retained on site. Those covenants and agreements shall be enforceable against the servient estate in that those protective covenants shall run with the land to all successors and assigns.

ARTICLE I

STATEMENT OF FACTS

1.01 The Property, totaling approximately [acres] [square yards] is more particularly described and depicted in Exhibit "A", attached hereto and incorporated herein by this reference. *[Exhibit "A" must include the legal description of the property used by the county recorder. This must include the particular description of the boundaries of the area to be subject to a particular use restriction. If the property does not already have a legal description (it generally will not if it is a portion of a larger piece of property) a survey will be required.]* The Property is located in the area now generally bounded by *[include narrative description of the area; this will typically be street names: e.g., Main Street on the north, Maple Street on the east, etc.]* County of [ ], State of California.

1.02 *[Use this paragraph if imposing additional restrictions on a portion of the Property, for example on a capped portion, or if for any other reason it is necessary to precisely identify any portion of the property, such as an area with groundwater monitoring wells. The purpose of this paragraph is to give the precise location of such areas where use restrictions generally will apply. Renumber following paragraphs accordingly.]* A limited portion of the Property is more particularly described in Exhibit "B" which is attached and incorporated by this reference ("Capped Property") as defined below *[or "(other identified) Property"]. [Exhibit B must include a legal description of the exact area(s) being restricted*

and any necessary diagram(s). This will generally require a legal survey and engineering drawing for the Cap or other area to be further restricted.] The [Capped *(or other description)*] Property is located in the area now generally bounded by [ ]. *[Include language that generally describes the Capped or other identified Property.]* The [Capped *(or other identified)* Property is also more specifically described as encompassing [ ] County Assessor's Parcel No.(s) [ ].

1.03 *[Briefly describe the remedial measures implemented at the Property, including, if applicable, installation of a cap and construction and ongoing operation and maintenance of a groundwater treatment system, in order to identify the remaining contaminants and physical remedial measures on the Property that necessitate this deed restriction. This paragraph should also briefly discuss the regulatory context for the DON facility. Reference should be made to any applicable Federal Facility Agreement (FFA) or Federal Facility Site Remediation Agreement(FFSRA) and any corrective action obligations under RCRA or Chapter 6.5 of Division 20 of the Health and Safety Code covered by the FFA or FFSRA. This paragraph should refer to, and give the approval date for, the RAP, ROD, RAW or other decision document that selected the remedial measures at the Property and required this Covenant.]*

SAMPLE [For a facility which has an FFA or FFSRA and hazardous waste management units]: The DON and the Department entered into a Federal Facility Agreement (FFA) on [date]. Pursuant to that FFA, the DON may satisfy some or all of its corrective action obligations under the Resource Conservation and Recovery Act

(RCRA)(42 USC 6901 et seq)or California Health and Safety Code sectin 25200.10 through CERCLA response actions. *{Proceed to additional SAMPLES as appropriate.]*

SAMPLE [For a property with remaining contamination, but no cap, O&M, or other ongoing response activities]: The Property is [a portion of a site] being remediated pursuant to a Record of Decision (ROD) pursuant to the Defense Environmental Restoration Program (DERP), 10 U.S.C. section 2701 et seq, and CERCLA; and a Remedial Action Plan (RAP) pursuant to Chapter 6.8 of Division 20 of the H&SC, under the oversight of the Department. The ROD/RAP provides that a deed restriction be required as part of the site remediation, because lead, which is a hazardous substance, as defined in H&SC section 25316, and a hazardous material as defined in H&SC section 25260 remains at depths of 10 feet or more below the surface of the Property. The DON circulated the ROD/RAP, for public review and comment. The ROD/RAP was approved by the DON and concurred in by the Department on [date], pursuant to which the Property was excavated to a depth of 10 feet, graded, then backfilled with clean soil.

SAMPLE [For a property with ongoing operation and maintenance of a monitoring or treatment system and/or cap. The exact provisions of this paragraph will vary depending upon the facts of the particular site or facility. The paragraph below is illustrative of the kind of information that should be included. Note specifically there is reference to a signed Operation and Maintenance Agreement.]: [Covenantor] *[or party responsible for the activity, if different from*

Covenantor] is remediating the Property under the supervision and authority of the Department. The Property is [a portion of a site] being remediated pursuant to a Record of Decision (ROD) pursuant to the Defense Environmental Restoration Program (DERP), 10 U.S.C. section 2701 et seq; and a Remedial Action Plan (RAP) pursuant to Chapter 6.8 of Division 20 of the H&SC. Because hazardous substances, as defined in H&SC section 25316, which are also hazardous materials as defined in H&SC section 25260, including volatile organic compounds, total petroleum hydrocarbons, chlorinated benzenes and polychlorinated biphenyls, remain in the soil and groundwater in and under portions of the Property, the Remedial Action Plan provides that a deed restriction be required as part of the site remediation. The DON circulated the ROD/RAP for public review and comment. The ROD/RAP were approved by the DON and concurred in by Department on [*date*]. Remediation includes installing and maintaining a synthetic membrane cover ("Cap") over the Capped Property. The Cap consists of a low permeability synthetic membrane and other associated layers, as more particularly described in the engineering drawing attached as Exhibit "B" hereto. The response action also includes the installation and operation of: (1) a passive gas collection system on the Capped Property which removes volatile organic compounds migrating upward from under the Cap, (2) a vapor extraction system, which remediates certain volatile organic compound-impacted soils, and (3) groundwater monitoring wells ("Monitoring Wells"). The location of the gas collection system, vapor extraction system, and Monitoring Wells are shown on Exhibit "B". *[This exhibit will have been identified in paragraph 1.02.]* The operation and maintenance of the Cap, gas collection system, vapor extraction system, and Monitoring Wells is pursuant to an Operation and

Maintenance Manual incorporated into the Operation and Maintenance Agreement between [Covenantor] *[or name of other entity]* and the Department dated [ ]. *[If an O&M Agreement has not been signed, the approval date for the O&M Manual or Plan should be referenced.]*

1.04 *[This paragraph should set out specific information about the risk assessment findings relevant to the contaminants of concern remaining at the property, essentially the basis for the restrictions imposed by this covenant. The Restrictions in Paragraphs 4.01, and any requirement for Soil Management Activity and any Prohibited Activity must be linked to the contaminants and risk assessment as discussed in this paragraph. The following paragraph is given for purposes of illustration. Each site will have different facts; those should be developed in a manner similar to the sample paragraph given here. Land use must be consistent with the approved RAW, RAP or ROD and the health risk assessment.]*

SAMPLE: As detailed in the Final Health Risk Assessment *[or other appropriate document]* as proposed by the Covenantor and approved by the Department on [*date*], all or a portion of the surface and subsurface soils within 10 feet of the surface of the Property contain hazardous substances, as defined in H&SC section 25316, which include the following metal contaminants of concern in the ranges set forth below: arsenic (0.3 to 38.1 parts per million ("ppm"), beryllium (2.6 ppm), copper (4.6 to 756 ppm, and nickel (7.3-105 ppm). In addition, there are low pH soils. Based on the Final Risk Assessment the Department and the Covenantor have

concluded that use of the Property as a residence, hospital, school for persons under the age of 21 or day care center would entail an unacceptable cancer risk to the users or occupants of such property operated or occupied. The Department and the Covenantor have further concluded that the Property, as remediated, and operated or occupied subject to the restrictions of this Covenant, does not present an unacceptable threat to human safety or the environment, if limited to *[as applicable:* commercial and industrial, parks, open space,*[or other appropriate]]* use.

SAMPLE: [Note: Groundwater restrictions in Paragraph 3.04 must be based on a discussion of what contaminants are found in groundwater at the site, and what the drinking water standards are.]

Groundwater at the Property is found 15 to 20 feet below ground surface. Contaminants in the groundwater include benzene (50- 123 ppm), chromium (75- 213 ppm) and TCE (350-780 ppm). California drinking water standards are benzene at 0.08 ppm, chromium at 30 ppm and TCE at 5 ppm. The Department and the Covenantor concludes that the groundwater presents an unacceptable threat to human health and safety absent an environmental restriction to eliminate exposure to such levels of groundwater.

ARTICLE II

DEFINITIONS

2.01 Department. "Department" means the State of California by and through the Department of Toxic Substances Control and includes its successor agencies, if any.

2.02 Owner. "Owner" shall include the Covenantor's successors in interest, and their successors in interest, including heirs and assigns, during his or her ownership of all or any portion of the Property.

2.03 Occupant. "Occupant" means Owners and any person or entity entitled by ownership, leasehold, or other legal relationship to the right to occupy any portion of the Property.

2.04 Covenantor. "Covenantor" shall mean the United States acting through the Department of the Navy (DON).

ARTICLE III

GENERAL PROVISIONS

3.01 Restrictions to Run with the Land. This Covenant sets forth protective provisions, covenants, restrictions, and conditions (collectively referred to as "Restrictions"), subject to which the Property and every portion thereof shall be improved, held, used, occupied, leased, sold, hypothecated, encumbered, and/or conveyed. These Restrictions are consistent with the separate restrictions placed in the deed by and in favor of the Covenantor, conveying the Property from the Convenantor to its successor in interest described above. Each and every Restriction: (a) runs with the land in perpetuity pursuant to H&SC sections 25222.1 25355.5(a)(1)(C) and Civil Code section 1471; (b) inures to the benefit of and passes with each and every portion of the Property; (c) shall apply to and bind all subsequent Occupants of the Property; (d) is for the benefit of, and is enforceable by the Department; and (e) is imposed upon the entire Property unless expressly stated as applicable only to a specific portion thereof.

3.02 Binding upon Owners/Occupants. Pursuant to H&SC sections 25222.1, 25355.5(a)(1)(C), this Covenant binds all Owners of the Property, their heirs, successors, and assignees, and the agents, employees, and lessees of the owners, heirs, successors, and assignees. Pursuant to Civil Code section 1471(b), all successive owners of the Property are expressly bound hereby for the benefit of the Department.

3.03 Written Notice of Hazardous Substance Release. The Owner shall, prior to the sale, lease, or rental of the Property, give written notice to the subsequent transferee that a release of hazardous substances has come to be located on or beneath the Property, pursuant to Health and Safety Code section 25359.7. Such written notice shall include a copy of this Covenant. *[This last sentence is optional, to be used at sites where it is important that buyers and tenants be specifically aware of the ongoing remediation and their obligations.]*

3.04 Incorporation into Deeds and Leases. The Restrictions set forth herein shall be incorporated by reference in each and all deeds and leases for any portion of the Property.

3.05 Conveyance of Property. The Owner shall provide notice to the Department not later than thirty (30) days after any conveyance of any ownership interest in the Property (excluding mortgages, liens, and other non-possessory encumbrances). The Department shall not, by reason of this Covenant alone, have authority to approve, disapprove, or otherwise affect a conveyance, except as otherwise provided by law, by administrative order, or by a specific provision of this Covenant.

ARTICLE IV

RESTRICTIONS

[The following examples are intended to be illustrative. Not all of them will be

applicable. The restrictions for a particular property should have a direct relationship to what the Health Risk Assessment said was appropriate for use at the site. The restrictions must also protect the integrity and physical accessibility of, and legal rights of access to, any ongoing remediation facilities at the site.]

4.01 Prohibited Uses. The Property shall not be used for any of the following purposes: ***[Note: These prohibitions must be based on the appropriate decision documents as set forth in Paragraphs 1.03 and 1.04]***

[Sample provisions:]

(a) A residence, including any mobile home or factory built housing, constructed or installed for use as residential human habitation.

(b) A hospital for humans.

(c) A public or private school for persons under 21 years of age.

(d) A day care center for children.

4.02. Soil Management ***[Note: The basis for the soil restrictions must be in Paragraphs 1.03 and 1.04]***

[Sample provisions]

(a) No activities that will disturb the soil [at or below [ ] feet below grade] (e.g., excavation, grading, removal, trenching, filling, earth movement or mining) shall be allowed on the Property without a Soil Management Plan and a Health and Safety Plan approved by the Department.

(b) Any contaminated soils brought to the surface by grading, excavation, trenching or backfilling shall be managed in accordance with all applicable provisions of state and federal law.

(c) The Owner shall provide the Department written notice at least fourteen (14) days prior to any building, filling, grading, mining or excavating in the Property [more than [ ] feet below the soil surface] [which will remove more than [ ] cubic yards of soil].

4.03 Prohibited Activities. ***[This paragraph will not be applicable to all sites. If not used, renumber accordingly. If there are groundwater restrictions, the basis must be in Paragraphs 1.03 and 1.04]*** The following activities shall not be conducted at the Property:

[Sample provisions]

(a) Raising of food (agricultural products intended for human consumption or use, including but not limited to food, cattle, fibers, including cotton).

(b) Drilling for [drinking irrigation] water, oil, or gas [without prior written approval by the Department].

[or] (b) Extraction of groundwater for purposes other than site remediation or construction dewatering.

[The following paragraphs are samples of restrictions that may be applicable when there is a cap, vapor and/or gas collection system, and/or groundwater monitoring system.]

4.04 Non-Interference with Cap [and Vapor Extraction System (VES)] and [Groundwater Capture System (GCS)].

[Sample provisions:]

(a) Activities that may disturb the Cap (e.g. excavation, grading, removal, trenching, filling, earth movement, or mining) shall not be permitted on or within _______ feet of the Capped Property without prior review and approval by the Department. ***[Similar restrictions may be appropriate for other ongoing remediation systems.]***

(b) All uses and development of the Capped Property shall preserve the integrity [***(if appropriate:)*** **and physical accessibility**] of the Cap. ***[Extend to other systems as appropriate.]***

(c) The Cap shall not be altered without written approval by the Department.

(d) The Owner shall notify the Department of each of the following: (i) the type, cause, location and date of any damage to the Cap and (ii) the type and date of repair of such damage. Notification to the Department shall be made as provided below within ten (10) working days of both the discovery of any such disturbance and the completion of any repairs. Timely and accurate notification by any Owner or Occupant shall satisfy this requirement on behalf of all other Owners and Occupants. ***[Extend to other systems as appropriate.]***

4.05 Access for Department. The Department shall have reasonable right of entry and access to the Property for inspection, monitoring, and other activities consistent with the purposes of this Covenant as deemed necessary by the Department in order to protect the public health or safety, or the environment.

ARTICLE V

ENFORCEMENT

5.01 Enforcement. Failure of the Owner or Occupant to comply with any of the

Restrictions specifically applicable to include grounds for the Department to require that the Owner modify or remove any improvements ("Improvements" herein shall mean all buildings, roads, driveways, and paved parking areas), constructed or placed upon any portion of the Property in violation of the Restrictions. Violation of this Covenant by the Owner or Occupant may result in the imposition of civil and/or criminal remedies including nuisance or abatement against the Owner or Occupant as provided by law. The State of California shall have all remedies as provided at in California Civil Code Section 815.7 as that enactment may be from time to time amended.

ARTICLE VI

VARIANCE AND TERMINATION

6.01 Variance. The Owner, or with the Owner's consent, any Occupant, may apply to the Department for a written variance from the provisions of this Covenant. Such application shall be made in accordance with H&SC section 25233. The Department will grant the variance only after finding that such a variance would be protective of human, health, safety and the environment.

6.02 Termination. The Owner, or with the Owner's consent, any Occupant, may apply to the Department for a termination of the Restrictions or other terms of this Covenant as they apply to all or any portion of the Property. Such application shall be made in accordance with H&SC section 25234. No termination or other terms of this Covenant shall extinguish or modify the retained interest held by the United States.

ARTICLE VII

MISCELLANEOUS

7.01 No Dedication Intended. Nothing set forth in this Covenant shall be

construed to be a gift or dedication, or offer of a gift or dedication, of the Property, or any portion thereof to the general public or anyone else for any purpose whatsoever.

7.02 Recordation. The Covenantor shall record this Covenant, with all referenced Exhibits, in the County of [name of county] within ten (10) days of the Covenantor's receipt of a fully executed original.

7.03 Notices. Whenever any person gives or serves any Notice ("Notice" as used herein includes any demand or other communication with respect to this Covenant), each such Notice shall be in writing and shall be deemed effective: (1) when delivered, if personally delivered to the person being served or to an officer of a corporate party being served, or (2) three (3) business days after deposit in the mail, if mailed by United States mail, postage paid, certified, return receipt requested:

To Owner: *[include name and address of Owner and name of person to receive service]*

To Department: *[title and address of Regional Branch Chief.]*

Any party may change its address or the individual to whose attention a Notice is to be sent by giving written Notice in compliance with this paragraph.

7.04 Partial Invalidity. If any portion of the Restrictions or other term set forth herein is determined by a court of competent jurisdiction to be invalid for any reason, the surviving portions of this Covenant shall remain in full force and effect as if such portion found invalid had not been included herein.

7.05 Statutory References. All statutory references include successor provisions.

IN WITNESS WHEREOF, the Parties execute this Covenant.

Covenantor: ***[name of Covenantor]***

By: ______________________________

Title: ***[signatory's name and title]***

Date: ______________

Department of Toxic Substances Control

By: ______________________________

Title: ***[signatory's name and title]***

Date: ______________

Approved as to form:

Date: ________________ By: __________________________

Approved as to form:

Date: ________________ By: __________________________

STATE OF CALIFORNIA)
)
COUNTY OF ______________________)

On this __________ day of ____________________, in the year __________,

before me ______________________________________, personally appeared

____,

personally known to me (or proved to me on the basis of satisfactory evidence) to be the person(s) whose name(s) is /are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

WITNESS my hand and official seal.

Signature ____________________________

MODEL HAZARDOUS WASTE MANAGEMENT PROGRAM

DEED RESTRICTION

RECORDING REQUESTED BY:
[Covenantor's Name]
[Street Address]
[City], California **[Zip Code]**

WHEN RECORDED, MAIL TO:

Department of Toxic Substances Control
Region ___
[Street Address]
[City], California **[Zip Code]**
Attention: **[Name of Branch Chief]**, Chief
[Branch Designation]

SPACE ABOVE THIS LINE RESERVED FOR RECORDER'S USE

COVENANT TO RESTRICT USE OF PROPERTY

ENVIRONMENTAL RESTRICTION

(Re: *[Insert parcel number(s) and name of site property to be restricted.]*)

This Covenant and Agreement ("Covenant") is made by and between the United States of America acting by and through the Department of Navy or "DON" (the "Covenantor"), the current owner of certain property situated in *[city]*, County of ______, State of California, described in Exhibit "A", attached hereto and incorporated herein by this reference (the "Property"), and the State of California acting by and through the Department of Toxic Substances Control (the "Department"). Pursuant to Civil Code section 1471(c), the Department has determined that this Covenant is reasonably necessary to protect present or future human health or safety or the environment as a

result of the presence on the land of hazardous materials as defined in Health and Safety Code ("H&SC") section 25260. In addition, pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 104 (42 USC Section 9604), as delegated to the Covenantor by E.O. 12580, ratified by Congress in 10 USC Sec. 2701, et seq., and implemented by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP – 40 CFR Part 300) and implementing guidances and policies, the Covenantor (DON) has also determined that this Covenant is reasonably necessary to protect present or future human health and safety and the environment as the result of the presence on the land of hazardous substances, pollutants and contaminants as defined in CERCLA Section 101 (42 USC Section 9601).

The Covenantor and the Department, collectively referred to as the "Parties", therefore intend that the use of the Property be restricted as set forth in this Covenant, in order to protect human health, safety and the environment.

The Covenantor retains sufficient legal title and interest in the subject property to insure continuing enforcement of the protective covenants and agreements contained within this Covenant to Restrict the Use of Property. Further in any subsequent transfers or conveyance of title to nonfederal entities the DON shall burden the property with additional deed covenants that insure that any subsequent deed or transfer contains the protective covenants and right of access and power to conduct monitoring interest contained herein and of wastes retained on site. Those covenants and agreements shall be enforceable against the servient estate in that those protective covenants shall run with the land to all successors and assigns.

ARTICLE I

STATEMENT OF FACTS

1.01 The Property, totaling approximately [acres] [---- square yards] is more particularly described and depicted in Exhibit "A", attached hereto and incorporated herein by this reference. *[Exhibit "A" must include the legal description of the property used by the county recorder. This must include the particular description of the boundaries of the area to be subject to a specific use restriction. A survey may be required].* The Property is located in the area now generally bounded by *[include narrative description of the area; this will typically be street names: e.g. Main Street on the north, Maple Street on the east, etc.]* County of [ ], State of California.

1.02 *[Use this paragraph if imposing additional restrictions on a portion of the Property, for example on a capped portion, or if for any other reason it is necessary to precisely identify any portion of the property, such as an area with groundwater monitoring wells. The purpose of this paragraph is to give the precise location of such areas where use restrictions will apply. Renumber following paragraphs accordingly]* A limited portion of the Property is more particularly described in Exhibit "B" which is attached and incorporated by this reference ("Capped Property" or "[*other identified*] Property"). *[Exhibit B must include a legal description of the exact area(s) being restricted and any necessary diagram(s). This will generally require a legal survey and engineering drawing for the Cap or other area to be further restricted.].* The [Capped or {other identified}] Property is located in the area now generally bounded by _____. *[include language that generally describes the Capped or other identified Property]* The

[Capped or {other identified}] Property is also more specifically described as encompassing xxxx County Assessor's Parcel numbers ---.

1.03 *[Briefly describe the regulatory oversight of the facility by the Department and the CERCLA decisions including any applicable Federal Facility Agreement (FFA) or Federal Facility site Remediation Agreement (FFSRA) and implementing activities of the Covenantor, the remedial activities that have occurred at the Property, including, if applicable, installation of a cap and construction and ongoing operation and maintenance of a groundwater treatment system. This paragraph should refer to the Closure Report or other decision document such as a ROD which approved the remedial activities at the Property and required this Covenant. The paragraph needs to identify the contaminants and physical remedial measures on the Property which necessitate this deed restriction.]*

Since [*date*] the Department [*or*, the Department's predecessor in interest (California Department of Health Services)] authorized this [treatment], [storage], [disposal] facility ("Facility") pursuant to an [interim status document] [permit]. Under this authorization the Site was a hazardous waste facility, regulated by the Department, subject to the requirements of the California Hazardous Waste Control Law ("HWCL"), at Health and Safety Code ("H&S Code") section 25100 et seq., and the federal Resource Conservation and Recovery Act ("RCRA"), at 42 U.S.C. section 6901 et seq. Pursuant to the closure requirements of the HWCL, including H&S Code section 25246 and post-closure notices provisions of Title 22 California Code of Regulations [section 66265.119(b) for interim status hazardous waste facilities] [*or* 66264.119(b) for permitted hazardous waste facilities]] [*or, if restrictions required for permit:* corrective action requirements of the HWCL, including H&S Code Section 25200.10] the Department is requiring this Covenant as part of the [facility closure] [corrective action] [permitting] of the facility. The Department circulated a [Closure Plan] [Remedial Measures Study] [*other appropriate document*], which contained a Final Health Risk Assessment [and/or Remedial Goals document], together with a draft [Environmental Impact Report] [Negative Declaration] pursuant to the California Environmental Quality Act, Public Resources Code section 21000 et seq for public review and comment from [*date*] to [*date*]. Because hazardous wastes, which are also hazardous materials as defined in Health and Safety Code sections 25117 and 25260, including [list hazardous wastes] remain in the [soil] and [groundwater] at the Property, the [Closure Plan] [Remedial Measures Study] provided that a deed restriction would be required as part of the facility remediation. The Department approved the [Closure Plan] [Remedial Measures Study] [*other appropriate document*] together with the [*environmental document*] on [*date*].

Pursuant to these documents, the Property was [*describe remedial actions taken which relate to what is left on the property. This description must include installation of any physical remedial measures. The description must identify what contaminants remain on the Property.*]

SAMPLE: Hazardous wastes, which are also hazardous materials as defined in H&S Code sections 25117 and 25260, and are CERCLA hazardous substances, pollutants or contaminant, including xxxx and yyyy, remain in the soil and groundwater at the Property. Remediation includes installing and maintaining a synthetic membrane cover ("Cap") over the Capped Property. The Cap consists of a low permeability

synthetic membrane and other associated layers over the hazardous wastes and materials, as more particularly described in the engineering drawing attached as Exhibit "B" hereto. The Remedial Measure also includes the installation and operation of: (1) a passive gas collection system ("GCS") on the Capped Property which removes miscellaneous gas/vapors migrating upward from under the Cap, (2) a vapor extraction system ("VES"), which remediates certain volatile organic compound-impacted soils, and (3) groundwater monitoring wells ("Monitoring Wells"). The location of the GCS, VES and Monitoring Wells are shown on the map attached as exhibit "--". The operation and maintenance ("O&M") of the Cap, GCS, VES, and Monitoring Wells is pursuant to an O&M Manual incorporated into the O&M Agreement between [Covenantor] *[or name of other entity]* and the Department dated September 20, 1995. *[If an O&M Agreement has not been signed, the approval date for the O&M Manual or Plan should be referenced]*

1.04 *[This paragraph should set out specific information about the risk assessment findings relevant to the contaminants of concern remaining at the property, essentially the basis for the restrictions imposed by this covenant. The Restrictions in Paragraphs 4.01, and any requirement for Soil Management Activity and any Prohibited Activity must be linked to the contaminants and risk assessment as discussed in this paragraph. The following paragraph is given for purposes of illustration. Each site will have different facts; those should be developed in a manner similar to the sample paragraph given here. You must consult with the assigned toxicologist about what are the appropriate land uses.]*

SAMPLE: As detailed in the Final Health Risk Assessment *[or other appropriate* *document]* as proposed by the Covenantor and approved by the Department on *[date]*, all or a portion of the surface and subsurface soils within 10 feet of the surface of the Property contain hazardous wastes and hazardous materials, as defined in H&S Code section 25117 and 25260, which include one or more of the following metal contaminants of concern in the ranges set forth below: arsenic (0.3 to 38.1 parts per million ("ppm"), beryllium (2.6 ppm), copper (4.6 to 756 ppm, and nickel (7.3-105 ppm). In addition, there are low pH soils. Based on the Final Risk Assessment the Department and the Covenantor have concluded that use of the Property as a residence, hospital, school for persons under the age of 21 or day care center would entail an unacceptable cancer risk to the users or occupants of such property. The Department and the Covenantor have further concluded that the Property, as remediated, and operated or occupied subject to the restrictions of this Covenant, does not present an unacceptable threat to human safety or the environment, if limited to *[as applicable:* commercial and industrial use, parks, open space, [or other appropriate] use*]*.

SAMPLE [Note: Groundwater restrictions in Paragraph 3.04 must be based on a discussion of what contaminants are found in groundwater at the site, and what drinking water standards are.]: Groundwater at the Property is first found at 15 to 20 feet below ground surface. Contaminants in the groundwater include benzene (50- 123 ppm), chromium (75- 213 ppm) and TCE (350-780 ppm). California drinking water standards are benzene at .08 ppm, chromium at 30 ppm and TCE at 5 ppm. The Department and the Covenantor concludes that the groundwater presents an unacceptable threat to human health and safety absent an environmental restriction to eliminate exposure to such levels of groundwater.

ARTICLE II

<u>DEFINITIONS</u>

2.01 <u>Department</u>. "Department" shall mean the State of California by and through the California Department of Toxic Substances Control and shall include its successor agencies, if any.

2.02 <u>Owner</u>. "Owner" shall include the Covenantor's successor's in interest, and their successors in interest, including heirs and assigns, during his or her ownership of all of any portion of the Property.

2.03 <u>Occupant</u>. "Occupant" shall mean Owners and any person or entity entitled by ownership, leasehold, or other legal relationship to the right to occupy any portion of the Property.

2.04 <u>Covenantor</u>. "Covenantor" shall mean the United States acting through the Department of the Navy (DON).

ARTICLE III

GENERAL PROVISIONS

3.01 Restrictions to Run With the Land. This Covenant sets forth protective provisions, covenants, restrictions, and conditions (collectively referred to as "Restrictions"), upon and subject to which the [Property] [Capped Property] [Restricted Property] and every portion thereof shall be improved, held, used, occupied, leased, sold, hypothecated, encumbered, and/or conveyed. These Restrictions are consistent with the separate restrictions placed in the deed by and in favor of the Covenantor, conveying the Property from the Covenantor to its successor in interest described above. Each and every one of the Restrictions: (a) shall run with the land in perpetuity pursuant to H&SC sections 25202.5, and 25202.6, and Civil Code section 1471; (b) shall inure to the benefit of and pass with each and every portion of the Property; (c) shall apply to and bind all subsequent Occupants of the Property; (d) are for the benefit of, and shall be enforceable by the State of California; and (e) are imposed upon the entire Property unless expressly stated as applicable only to a specific portion thereof.

3.02 Binding Upon Owners/Occupants. Pursuant to Health and Safety Code section 25202.5(b), this Covenant shall be binding upon all of owners of the land, their heirs, successors, and assignees, and the agents, employees, and lessees of the owners, heirs, successors, and assignees. Pursuant to Civil Code section 1471(b), all successive owners of the Property are expressly bound hereby for the benefit of the covenantee(s) herein.

3.03 Written Notice of Hazardous Substance Release. The Owner shall, prior to the sale, lease, or rental of the Property, give written notice to the subsequent

transferee that a release of hazardous substances has come to be located on or beneath the Property, pursuant to Health and Safety Code section 25359.7. Such written notice shall include a copy of this Covenant. *[This last sentence is optional, to be used at sites where it is important that buyers and tenants be specifically aware of the ongoing remediation and their obligations]*

3.04 Incorporation Into Deeds and Leases. The Restrictions set forth herein shall be incorporated by reference in each and all deeds and leases for any portion of the Property.

3.05 Conveyance of Property Covenantor agrees that the Owner shall provide notice to the Department not later than thirty (30) days after any conveyance of any ownership interest in the Property (excluding mortgages, liens, and other non-possessory encumbrances). The Department shall not, by reason of this Covenant alone, have authority to approve, disapprove, or otherwise affect such conveyance. *[This paragraph is optional, to be used, for example, at sites with groundwater treatment systems that will require access by the Department and by the entity responsible for O&M.]*

ARTICLE IV

RESTRICTIONS

[The following examples are intended to be illustrative. Not all of them will be applicable. The restrictions for a particular property should have a direct relationship to what the Health Risk Assessment said was ok/appropriate for use at the site. The toxicologist must be involved with drafting the Restrictions. The restrictions must also protect the integrity of, and access to, any ongoing remediation facilities at the site.]

4.01 Prohibited Uses. The Property shall not be used for any of the following purposes: *[Note: These prohibitions must be based on the facts and Health Risk Assessment as set forth in Paragraph 1.04]*

[sample provisions]

(a) A residence, including any mobile home or factory built housing, constructed or installed for use as residential human habitation.

(b) A hospital for humans.

(c) A public or private school for persons under 21 years of age.

(d) A day care center for children.

4.02 Soil Management *[Note: The basis for the soil restrictions must be in Paragraph 1.04]*

[sample provisions]

(a) No activities which will disturb the soil *[*at or below xxx feet below grade*]* (e.g., excavation, grading, removal, trenching, filling, earth movement or mining) shall be permitted on the Property without a Soil Management Plan and a Health and Safety Plan submitted to the Department for review and approval.

(b) Any contaminated soils brought to the surface by grading, excavation, trenching or backfilling shall be managed in accordance with all applicable provisions of state and federal law.

(c) The Owner will provide the Department written notice at least fourteen (14) days prior to any building, filling, grading, mining or excavating in the Property [more than feet below the soil surface] [which will remove more than cubic yards of soil].

4.03 Prohibited Activities. *[This paragraph will not be applicable to all sites. If*

not used, renumber accordingly. If there are groundwater restrictions, the basis must be in Paragraph 1.04] The following activities shall not be conducted at the Property:

[sample provisions]

(a) No raising of agricultural products intended for human consumption or use, including but not limited to food,cattle, fibers including, cotton) shall be permitted on the property.

(b) No drilling for *[*drinking/IRRIGATION *]* water, oil, or gas shall be permitted on the Property *[*without prior written approval by the Department*]*. *[or]* (b) No groundwater shall be extracted on the Property for purposes other than site remediation or construction dewatering. *[The following paragraphs are samples of restrictions that may be applicable when there is a cap, vapor and/ or gas collection system, and/or groundwater monitoring system.]*

4.04 Non-Interference with Cap [and VES] and [GCS].

[sample provisions]

(a) No activities which will disturb the Cap (e.g. excavation, grading, removal, trenching, filling, earth movement, or mining) shall be permitted on or within _____feet of the Capped Property without prior review and approval by the Department. *[Similar restrictions may be appropriate for other ongoing remediation systems.]*

(b) All uses and development of the Capped Property shall preserve the integrity of the Cap. *[Extend to other systems as appropriate.]*

(c) Any proposed alteration of the Cap shall require written approval by the Department.

(d) The Owner shall notify the Department of each of the following: (i) The type, cause, location and date of any disturbance to the Cap which could affect the ability of the Cap to contain subsurface hazardous wastes or hazardous materials in the Capped Property, and (ii) the type and date of repair of such disturbance. Notification to the Department shall be made as provided below within ten (10) working days of both the discovery of any such disturbance(s) and the completion of any repairs. Timely and accurate notification by any Owner or Occupant shall satisfy this requirement on behalf of all other Owners. *[Extend to other systems as appropriate.]*

4.05 Access for Department. The Department shall have reasonable right of entry and access to the Property for inspection, monitoring, and other activities consistent with the purposes of this Covenant as deemed necessary by the Department in order to protect the public health and safety and the environment.

ARTICLE V

ENFORCEMENT

5.01 Enforcement. Failure of the Owner or Occupant to comply with any of the Restrictions specifically applicable to it shall be grounds for the Department, by reason of this Covenant, to require that the Owner modify or remove any improvements ("Improvements" herein shall include all buildings, roads, driveways, and paved parking areas, constructed or placed upon any portion of the Property constructed in violation of the Restrictions). Violation of this Covenant by the Owner or Occupant may result in the imposition of civil and/or criminal remedies including nuisance or abatement against the Owner or Occupant as provided by law. The State of California shall have all remedies as provided in California Civil Code, Section 815.7, as that enactment may

be from time to time amended.

ARTICLE VI

MODIFICATION AND TERMINATION

6.01 Modification. Any Owner or, with the Owner's written consent, any Occupant of the Property or any portion thereof may apply to the Department for a written modification from the provisions of this Covenant. Such application shall be made in accordance with H&S Code section 25202.6. The Department will grant the modification only after finding that such a modification would be protective of human health, safety and the environment.

6.02 Termination. Any Owner, and/or, with the Owner's written consent, any Occupant of the Property, or any portion thereof, may apply to the Department for a termination of the Restrictions or other terms of this Covenant as they apply to all or any portion of the Property. Such application shall be made in accordance with H&S Code section 25202.6. The Department will grant the termination only after finding that such a termination would be protective of human health, safety and the environment. No termination of the Restrictions or other terms of this Covenant shall extinguish or modify the retained interest held by the United States.

ARTICLE VII

MISCELLANEOUS

7.01 No Dedication Intended. Nothing set forth in this Covenant shall be construed to be a gift or dedication, or offer of a gift or dedication, of the Property, or any portion thereof to the general public or anyone else for any purpose whatsoever.

7.02 Recordation In accordance with HSC Section 25235, the Department will record this Covenant, with all referenced Exhibits, in the County of [name of county] within ten (10) days of the Department's receipt of a fully executed original.

7.03 Notices. Whenever any person gives or serves any notice ("Notice" as used herein includes any demand or other communication with respect to this Covenant), each such Notice shall be in writing and shall be deemed effective: (1) when delivered, if personally delivered to the person being served or to an officer of a corporate party being served, or (2) three (3) business days after deposit in the mail, if mailed by United States mail, postage paid, certified, return receipt requested:

To Owner: *[include name and address of Owner and name of person to receive service]*

To Department: *[include name, address, and appropriate name of Department person to be served]*

Any party may change its address or the individual to whose attention a notice is to be sent by giving written notice in compliance with this paragraph.

7.04 Partial Invalidity. If any portion of the Restrictions or other term set forth herein is determined by a court of competent jurisdiction to be invalid for any reason, the surviving portions of this Covenant shall remain in full force and effect as if such portion found invalid had not been included herein.

7.05 Statutory References. All statutory references include successor provisions.

IN WITNESS WHEREOF, the Parties execute this Covenant.

"Covenantor"

Date:________________ By:________________________

"Department"

Date:________________ By:________________________

Approved as to form:

Date: ________________ By: ________________________

Approved as to form:

Date: ________________ By: ________________________

STATE OF CALIFORNIA)
)
COUNTY OF ______________________)

On this __________ day of ________________, in the year ________,

before me ________________________________, personally appeared

____,

personally known to me (or proved to me on the basis of satisfactory evidence) to be the person(s) whose name(s) is /are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(ies), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

WITNESS my hand and official seal.

Signature ________________________

ATTACHMENT B

PRINCIPLES AND PROCEDURES FOR SPECIFYING, MONITORING AND ENFORCEMENT OF LAND-USE CONTROLS AND OTHER POST-ROD ACTIONS

PRINCIPLES AND PROCEDURES FOR SPECIFYING, MONITORING AND ENFORCEMENT OF LAND USE CONTROLS AND OTHER POST-ROD ACTIONS

PREAMBLE

Since the Department of Defense (DoD) /Environmental Protection Agency (EPA) Model Interagency Agreement (IAG)/Federal Facility Agreement (FFA) was developed in 1988, EPA and Navy have gained considerable knowledge and understanding about post-Records of Decisions (ROD) activities, especially Land Use Controls (LUCs). Thinking, policies, regulations and procedures concerning LUCs have evolved considerably since DoD and EPA developed the 1988 FFA model language. New statutes and regulations related to LUCs are being considered in many states. Accordingly, EPA and the Department of the Navy (DON) believe that a set of Principles will assist Navy field commands and EPA Regions to better implement our respective Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) responsibilities. The Principles described below do not replace or substitute for any existing CERCLA statutory or regulatory requirement. Rather they provide a mutually agreeable framework to provide a more efficient process to implement LUCs at National Priority List (NPL) installations.

These Principles will guide the EPA and DON personnel involved in these decisions. They are written in full knowledge that state regulatory and trustee organizations have independent responsibilities and authorities. EPA and the DON recognize the importance of the state role in helping to ensure a cleanup is protective of human health and the environment. Headquarters EPA and DoD will jointly develop a communications plan to ensure we include the states in this important issue.

These Principles support the President's Management Agenda by focusing on improving environmental results. The Principles encourage continued innovation and improvement in CERCLA implementation. EPA and the Components should continue to propose and pilot initiatives at Component installations or at other properties for which they are responsible. This includes proposing variations in, or alternatives such as performance-based practices to, the approach described in this document.

PRINCIPLES

- At sites where remedial action is determined necessary to protect human health and the environment, the actions must be documented in accordance with CERCLA and its implementing regulation, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).

- At sites where contaminants are left in place at levels that do not allow for unrestricted use, LUCs are used to ensure that the contaminants do not pose an unacceptable risk to human health or the environment. LUCs consist of engineering controls and/or institutional controls.

- The EPA and DON desire to ensure that LUCs are specified, implemented, monitored, reported on, and enforced in an efficient, cost-effective manner that ensures long-term protectiveness. In addition, in accordance with CERCLA and the NCP, if an equally protective but more cost-effective remedy is identified, DON may propose, and EPA will consider, using the more cost-effective remedy.

- The EPA acknowledges the DON's role and responsibilities as the Federal Lead Agent for response actions. This role includes selecting remedies with EPA at NPL sites and funding response actions.

- The DON acknowledges EPA's role and responsibilities for regulatory oversight and enforcement at NPL sites. This role includes ultimate ability to select the remedy at NPL sites if EPA disagrees with DON's proposed remedy and dispute resolution fails.

- Federal Facilities Agreements (FFAs) are CERCLA 120 agreements used by DON and EPA to describe in detail the roles and relationships among DON, EPA and often the state. They form the foundation for these relationships regarding DON's response actions at NPL sites. FFAs also contain installation specific details and procedures for planning, budgeting, and dispute resolution. DON and EPA desire FFAs to be as standardized as possible and relatively <u>static</u> (i.e., the FFA should not need to be changed for a given installation).

- Primary Documents developed under the FFA are relatively <u>dynamic</u> and document important plans and actions. In that sense, they are action-oriented. For example, a Site Management Plan is revised yearly via collaboration among DON and EPA remedial project managers and is an important tool for planning response actions and demonstrating commitment to the public. Likewise, a LUC Remedial Design (RD) or Remedial Action Work Plan (RAWP) describes those actions that are needed to ensure viability of both long-term engineered and institutional control remedies.

- Records of Decision should document the remedy selection process and remedy decision in accordance with CERCLA and the NCP, as well as applicable and appropriate guidance, regulations, standards, criteria, and policy. With regard to LUCs, the ROD should describe the LUC objectives; explain why and for what purpose the LUCs are necessary, where they will be necessary, and the entities responsible for implementing, monitoring, reporting on and enforcing the LUCs. The ROD will refer to the RD or RAWP for implementation actions.

- Where situations arise (such as new cleanup standards; new or additional contamination is discovered on a site, etc.) that require additional response actions that go beyond the actions and objectives described in a ROD, and any related ROD Amendment or Explanation of Significant Difference (ESD), the additional actions required and their remedial objectives will be further documented in an ESD or ROD Amendment, as appropriate. There may also arise situations after a remedy has been completed that require removal actions to protect human health and the environment, such as the newly discovered contamination posing an imminent risk to human health. In such circumstances, documentation as required in the removal process should be created.

- Given the above, EPA and DON agree that the most efficient framework for specifying, implementing, monitoring, reporting on and enforcing LUCs is:
  - a standard FFA for NPL sites,
  - a clear, concise RoD with LUC objectives, and
  - a RD or RAWP with LUC implementation actions.

Note: These documents are described more fully below.

- EPA and DON will move expeditiously to finalize all outstanding FFAs using a standard FFA template as a guide to minimize the development/writing process.

Note: A "standard FFA" means the Agreement presently being used between EPA and DoD using the DoD-EPA model language, plus site-specific statements of fact, plus the additional primary document shown in Attachment (1).

- EPA and DoD will initiate a task force with appropriate headquarters and field representatives from EPA and the military services. The task force will make recommendations as to how to ensure that the same documentation can be used to memorialize both remedial action completion and deletion, as well as to determine the process whereby DoD and EPA will document the completion of the remedial actions required by the ROD in a single primary document. The task force will examine ways to reduce document size, review time, and revisions. The task force will recommend changes to guidance and policy that will help reduce document size or streamline the process in order to manage costs. The task force may also include other stakeholders.

After reviewing the task force recommendations EPA and DoD will determine how to ensure that the same documentation can be used to memorialize both remedial action completion and deletion, as well as to determine the process whereby DoD and EPA will document the completion of the remedial actions required by the ROD in a single primary document. In addition, EPA and DoD will streamline the remedial process and better manage costs. While the efforts of the Task Force are meant to complement the Principles described above, its work is separate from the Principles and must not impede their implementation. The work of the Task Force also must not impede completion or closeout of individual sites or operable units.

GENERAL PROCEDURES

1. Federal Facility Agreement

- The LUC implementation and operation/maintenance actions will be included in the RD or RAWP which are already primary documents deliverable under standard FFAs. In addition, the same documentation as determined by the task force and approved by the Parties to memorialize both the remedial action completion and deletion will be provided as a primary document for new FFAs. For existing FFAs without such a primary document, this document will be provided as an attachment to the RD or RAWP with the same enforceability as a primary document.

Note: Model FFA language will need to be supplemented to reflect these Principles and Procedures. Attachment (1) contains necessary modifications to FFA language.

2. Record of Decision

- It is EPA's and DON's intent that Records of Decision (RoDs) continue to be consistent with CERCLA and the National Contingency Plan. Relative to land use controls and institutional controls, the ROD shall:
  - Describe the risk(s) necessitating the remedy including LUCs;
  - Document risk exposure assumptions and reasonably anticipated land uses;
  - Generally describe the LUC, the logic for its selection and any related deed restrictions/notifications;
  - State the *LUC performance objectives*. (See attachment (2) for examples of LUC performance objectives);
  - List the parties responsible for implementing, monitoring, reporting on, and enforcement of the LUC;
  - Provide a description of the area/property covered by the LUC (should include a map);

– Provide the expected duration of the LUCs; and
– Refer to the RD or RAWP for LUC *implementation actions*, since these details may need to be adjusted periodically based on site conditions and other factors. (See attachment (2) for examples of LUC implementation actions).

- The ROD at transferring properties will need to be crafted based on the responsibilities of the new owner and state-specific laws and regulations regarding LUCs. At transferring properties, compliance with the LUC performance objectives may involve actions by the subsequent owners in accordance with deed restrictions, however, ultimate responsibility for assuring that the objectives are met remains with DON as the party responsible under CERCLA for the remedy. DON and regulators will consult to determine appropriate enforcement actions should there be a failure of a LUC objective at a transferred property.

3. <u>LUC Remedial Design (RD) or Remedial Action Work Plan (RAWP)</u>

- The RD or RAWP will be provided as a primary document in accordance with the FFA.
- The RD or RAWP will describe short and long-term implementation actions and responsibilities for the actions in order to ensure long-term viability of the remedy which may include both LUCs (e.g., institutional controls) and an engineered portion (e.g., landfill caps, treatment systems) of the remedy. The term "implementation actions" includes all actions to implement, operate, maintain, and enforce the remedy. Depending on the LUC and site conditions, these actions can include:
- Conducting CERCLA five-year remedy reviews for the engineered remedies and/or LUCs.
- Conducting periodic monitoring or visual inspections of LUCs; frequency to be determined by site-specific conditions.
- Reporting inspection results.
- Notifying regulators prior to any changes in the risk, remedy or land use including any LUC failures with proposed corrective action.
- Including a map of the site where LUCs are to be implemented.

For active bases,

– Developing internal-DON policies and procedures with respect to LUC monitoring, reporting, and enforcement in order to institutionalize LUC management and to ensure base personnel are aware of restrictions and precautions that should be taken; Consulting with EPA at least 14 days prior to making any changes to these policies and procedures to ensure that any substantive changes maintain a remedy that is protective of human health and the environment.
– Developing a comprehensive list of LUCs with associated boundaries and expected durations.
– Notifying regulators of planned property conveyance, including federal-to-federal transfers. "Property conveyance" includes conveying leaseholds, easements and other partial interests in real property.
– Obtaining regulator concurrence before modifying or terminating land use control objectives or implementation actions.

For closing bases/excess property:

– Notifying regulators of planned property conveyance, including federal-to-federal transfers.
– Consulting with EPA on the appropriate wording for land use restrictions and providing a copy of the wording from the executed deed.
– Defining responsibilities of the DON, the new property owner and state/local government agencies with respect to LUC implementation, monitoring, reporting, and enforcement.
– Providing a comprehensive list of LUCs with associated boundaries and expected durations.
– Obtaining regulator concurrence before modifying or terminating land use control objectives or implementation actions.

Note: The mix of responsibilities among DON, the new property owner, and other government agencies depends on state and federal laws and regulations that are applied in the state. Implementation actions at closing bases may include elements characteristic of both active and closing bases, depending on the timing of transfer.

- Should there be a failure to complete LUC implementation actions at an active base, the EPA Region shall notify the installation and seek immediate action. Should there be a failure to complete LUC actions after such notification to the base, EPA may notify the Deputy Assistant Secretary of the Navy (Environment) who will ensure that LUC actions are taken.

- Should there be a failure to complete implementation actions that are the responsibility of a subsequent owner or third party at a transferred property, EPA and DON will consult on the appropriate enforcement action. Should there be a failure to complete implementation actions that are the remaining responsibility of DON at a transferred property, the EPA Region will notify the cognizant Navy

Engineering Field Division. If necessary, EPA may notify the Deputy Assistant Secretary of the Navy (Environment) who will ensure that corrective action is taken.

Note: The RD or RAWP should contain no more or no less implementation actions than needed to ensure the viability of the remedy. There is a delicate balance required. EPA and DON both desire to ensure protectiveness while minimizing process and documents. The parties agree to work diligently to define the appropriate implementation actions for each LUC. EPA and DON believe the key elements can be easily developed between RPMs in a matter of a few hours. Based on detailed discussions and the examples shown in Attachment (2), EPA and DON expect that the LUC portion of the RDs or RAWPs to be in the range of 2-6 pages. If combined with a sampling plan, there may be additional pages needed to list the analyses, sampling locations and frequencies.

4. LUC Data

- The DON will ensure that all LUCs at its installations are included in the Service LUC database.

Attachments:
1. Incorporating Land Use Control (LUC) Objectives and Implementing Actions into Federal Facilities Agreements (FFAs)
2. Examples of LUC objectives and LUC Implementation Actions

Attachment 1

INCORPORATING LAND USE CONTROL (LUC) OBJECTIVES AND IMPLEMENTATION ACTIONS INTO FEDERAL FACILITIES AGREEMENTS (FFAs)

FFA Model Template Additions/Changes

1. Definitions Section:

Add: "Land use controls" shall mean any restriction or administrative action, including engineering and institutional controls, arising from the need to reduce risk to human health and the environment.

2. Primary Documents:

Add: A document memorializing remedial action completion.

Note: EPA and DoD believe it is important that a primary document: (1) document the completion of remedy-in-place and/or site close-out and (2) receive concurrence from EPA. The task force discussed above will make recommendations on the scope and content of the document, and DoD and EPA will determine this document after reviewing the task force recommendations. In the meantime, EPA and DON shall enter into FFAs which include a primary document memorializing remedy completion. The document shall not duplicate information in the Administrative Record or previously provided to EPA. Previously provided information shall be referenced and itemized. New information/data (e.g., sampling data) may be needed to demonstrate that the Remedial Action Objectives have been met. The report shall also include any as-built drawings for remedies if different from the remedial design. EPA and DoD do not envision this to be a lengthy document, but shall contain only the information needed to justify the remedy completion. EPA and DoD believe the document should discuss how the remedial objectives in the ROD have been met. It should not be used to expand the scope of requirements beyond the remedial actions required in the original ROD or any subsequent amendment or explanation of significant difference. Instead, if new requirements are needed for a protective remedy, these will be documented in an Explanation of Significant Difference or ROD Amendment, as appropriate, prior to reaching the milestone. The EPA and DoD will determine the precise nature of this document after reviewing the task force's recommendations.

Change: Eliminate the sub-bullets (subsidiary documents) under remedial action work plan for document streamlining purposes.

Attachment 2

EXAMPLES OF LUC OBJECTIVES AND LUC IMPLEMENTATION ACTIONS
(Note: Actions are to be tailored to site-specific conditions.
This is neither a mandatory nor a complete list)

LUC OBJECTIVES (contained in ROD)

- Ensure no construction on, excavation of, or breaching of the landfill cap.
- Ensure no residential use or residential development of the property.
- Ensure no withdrawal and/or use of groundwater.
- Ensure no excavation of soils without a use permit and special handling procedures.

LUC IMPLEMENTATION ACTIONS (contained in the RD or RAWP)

- Conduct a CERCLA five-year remedy review of the LUC and provide to EPA for review.
- Conduct annual inspections of the LUC and report results (active or BRAC – responsible party to be defined).
- Record the LUC in the base master plan. (active)
- Produce a survey plat of the LUC by a state registered land surveyor. (active or BRAC).
- File the survey plat with the local government/Circuit Court for purposes of public notification (active or BRAC)
- Place a survey plat in CERCLA administrative record, and send copies to EPA and state. (active or BRAC).
- Develop and implement a base procedure that requires excavation to be approved by the Public Works Officer or equivalent official. (active)
- Develop and implement a base procedure that requires changes in land use to be approved by the Public Works Officer or equivalent official. (active)
- Notify the regulatory agencies 45 days in advance of any Base proposals for a major land use change at a site inconsistent with the use restrictions and exposure assumptions described in the RoD, any anticipated action that may disrupt the effectiveness of the land use controls, any action that might alter or negate the need for the land use controls, or any anticipated transfer of the property subject to the land use controls.
- Obtain regulator concurrence before modifying or terminating land use control objectives or implementation actions.
- Maintain a comprehensive list of LUCs with associated boundaries and expected durations.

Note: These examples are consistent with draft EPA guidance: "Describing Institutional Controls in Remedy Decision Documents at Active Federal Facilities".